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FEBRUARY, 1904. VOL. XXIII. NO. 2.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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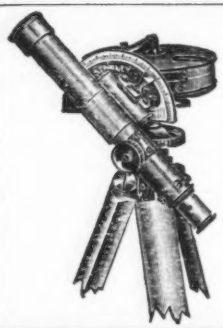

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NOTICES.*

The Year Book.—The Year Book for 1903 is now ready, and can be obtained by any Fellow by applying personally or by letter to the Chief Clerk, 1, Savile Row, London, W.

Evening Meetings in February.—Monday, February 8. Turkestan and a Corner of Tibet. By Oscar T. Crosby.—**Monday, February 22.** (1) A Pioneer Expedition in Angola. By Captain Boyd A. Cuninghame and J. Withers Gill. (2) A Journey in Southern Abyssinia. By Major P. H. G. Powell-Cotton.

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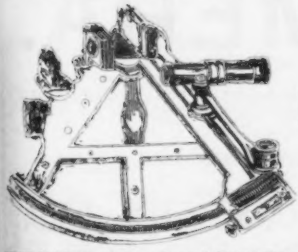

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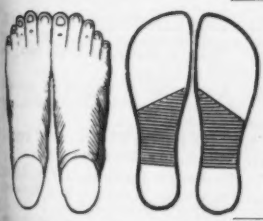

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The
Geographical Journal.

No. 2. FEBRUARY, 1904. Vol. XXIII.

THE PATAGONIAN ANDES.*

By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B.

The Patagonian Andes differ in many of the essential features of their geographical conformation from that magnificent mountain system which, further north, is at once the pride and the despair of the Western States of South America. The grand simplicity of structure in the northern system, the magnificent continuity and lofty grandeur of its main ranges, the altitude of its dominating peaks, its terrible and forbidding wastes of desolate and highly elevated tableland,—all these are wanting in the mountain masses of the farther south. A peak of 10,000 feet in altitude is quite exceptional in Patagonia, and, as one drifts further and further southward, the comparative depression of its complex orographical structure is such that we may cross and recross the whole width of the system without ever rising higher than 3000 or 4000 feet. The Patagonian Andes form, as it were, the half-submerged and flattened end of the vast Andine mass, of which they are but the natural southern extension; but it must be remembered that we are dealing only with visible structure above sea-level. The mighty axis of terrestrial upheaval which is indicated by the lofty central peaks of the northern Andes, may possibly exist, flattened, broken, defaced, and depressed, in Patagonia, and may even possibly extend south of Patagonia to the southern antarctic pole. Take the dividing-line of 41° S. lat., which is approximately the northern limit of political Patagonia, and you will find that it is approximately also the line from which the Andes, reaching southwards, assume the more complex and irregular formation which is distinctive of Patagonian

* Read at the Royal Geographical Society, December 14, 1903. Map, p. 280.

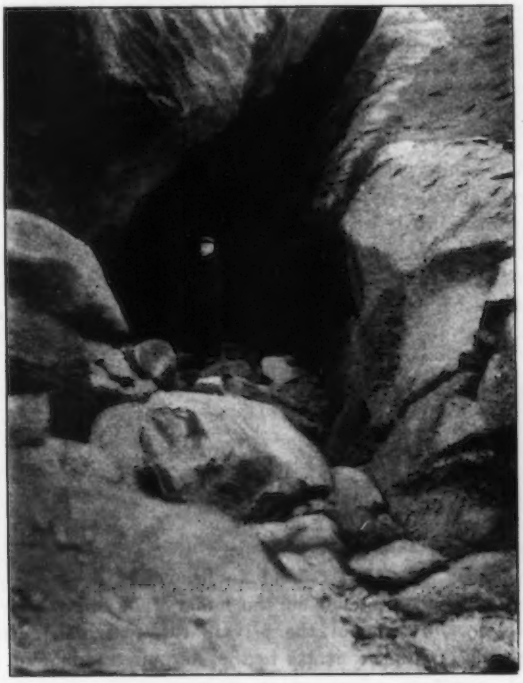
territory. Look at the map of South America, and you will see that the Pacific seaboard is denoted by a firm and unbroken line as far south as the head of the Bay of Ancud, nearly on the parallel of 41°, and in the same latitude as the great central depression of Nahuel Huapi; but that from that point southwards it is lost in the mazes of an intricate system of sea inlets which cover a meridional zone to the west of the Andes, and extends to the southern extremity of the continent. Within this zone islands innumerable rear their granite heads, polished and rounded by primeval ice-caps, and seamed here and there by glaciers; fringed with all the luxuriant beauty of a vegetation which dips to the still waters of the inland seas and shadows the rocky edge of slopes submerged to almost unfathomable depths. Set your foot on the shores of these islands, and attempt a process of exploration, and you will probably find yourself up to your waist in the depths of a slushy, moss-covered bog, and entangled in a swampy growth of water-plants of every conceivable variety. The general wetness of these half-submerged islands quite surpasses all ordinary experience.

Separating this band of islands and inlets—this western archipelago—from the eastern cordillera is a central line of considerable general elevation, which is so buried beneath perpetual snowfields and glaciers that it has only been partially explored, and is but indifferently known. It is distinguished by a magnificent series of snowcapped volcanic peaks, but in general altitude possesses no great superiority over the more accessible mountains further east. The secret of its topographical configuration in detail is hidden beneath snowfields, but we know that it is constantly broken across by deep depressions, which carry a great part of the waters collected in the central lakes of the Andes to the Pacific ocean; and we may conjecture that, were the snow-cap removed, we should find no very great divergence in superficial conformation from the flanking submerged zone to the west.

No simple orographical structure is to be readily traced in the extraordinary complication of Patagonian configuration, although the general theory of land construction and destruction advanced by Darwin, and supported by the eminent Chilean geographer Fonck, may be accepted as correct in broad principle. Between these volcanic peaks are enormous massifs of mountain formation, irregular and complex in form, where jagged peaks are usually hidden in the cloud-drifts from the Pacific, which rest upon the ice-beds intersecting them. This series of massive mountain blocks in some parts presents all the appearance of a continuous range from the sea, but we know that it is traversed frequently by the deep indentations of the Pacific drainage from the lake region, and that the conformation of these depressions, altered and moulded by recent glaciers (for all this Patagonian region

is undoubtedly undergoing a rapid process of desiccation), occasionally betoken the primæval existence of sea inlets. Actual geological evidence in the form of marine fossils is, however, wanting, to prove that the present fresh-water channels and depressions which cross this zone from east to west were ever sea-water inlets connecting the Pacific with the Atlantic, however much orographical evidence may point to that conclusion.

To the east of this raised central line of snows and glaciers lies a



ICE-CAVE, ROMANCHE BAY, TIERRA DEL FUEGO.

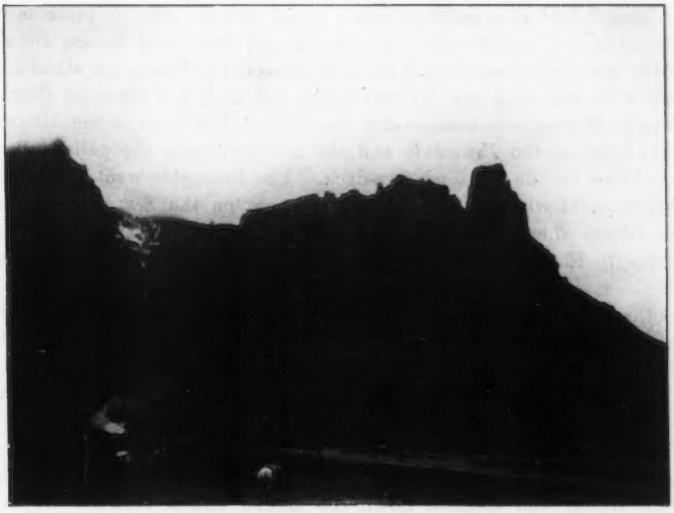
third line or zone of meridional depression, between which and the submerged zone to the west we find a direct analogy.

The contrast which is presented between the firm decided line of the Pacific coast to the north and the much-broken edge of submerged Patagonia to the south, is not more striking than is that between the well-defined cordillera of the Andes to the north of the parallel of 41° S. lat. and the irregular and complex system of mountain sierras or ridges below that latitude. These latter group themselves about the great lake depressions precisely as the Pacific straits and inlets are

enclosed amongst the granite massifs of the archipelago. Indeed, all Patagonia to the south of Lake Nahuel Huapi indicates a geologically recent age of half submergence; and it was through an immense system of ancient lake beds and sea inlets (separated and divided by groups of mountain peaks which were sometimes piled on a massive isolated pedestal of crystalline rock, sometimes strung out into jagged lines of sierra or ridge) fringed with moraines or terraces; shaped and reshaped by the ice-agency of at least two glacial epochs; amidst mountains which have been split again and again by stupendous volcanic action, and through enormous masses of volcanic deposit, that the British Commission party worked its way whilst examining the geographical conditions of a large area of territory in dispute between the two republics of Chile and Argentina.

Proceeding to the geographical examination of the territory in dispute, we crossed the Uspallata pass on the direct route between Buenos Aires and Santiago on the morning of March 1, 1902, witnessing as we went the effects of early dawn on the summit of Aconcagua—when the rose-tinted fretwork of its snowy summit stood sharp and clear against the blue of a cloudless sky—and then we dropped suddenly down into the lovely valley which leads to Santa Rosa de los Andes, till we touched the railhead some miles below the pass. Leaving about 7000 feet of rough weather-scarred mountain-side behind us, we were soon in all the glorious luxuriance of western Andine vegetation. Willows, poplars, figs, and peach trees crowded thickly about the terraced fields of Indian corn, wheat, hemp, and lucerne, which filled the little valleys and the shelves of the hillsides wherever space could be found for a spade to work. It was early autumn, and driven horses were pounding out the wheat with their unshod hoofs even then; the busy autumn season was a little too significant of the quick-coming winter. The long central valley of Chile between the Andes and the coast ranges is a continuous garden of luxuriant beauty from Santiago southwards. Santiago stands in the midst of it, and the sweet cultivated loveliness of some of the private estates which surround the capital offers a fragrant contrast to the sterner grandeur of mountain forms and mountain colour which encloses them. Love of nature's beauty seems to be inherent in the Chilean. Trees and flowers, clouds and sunsets—these things appeal to him just as imposing buildings, magnificent streets, miles of wharfage, and acres of wool-sheds appeal to Argentine imagination. And yet, of the two races, it is probable that the Argentine is the more imaginative. There is indigenous art and literature in Argentina, derived from a Spanish ancestry who emigrated from the southern provinces of Spain as well as from the north; in whose veins ran the blood of the Arab conqueror, and who could trace descent from Saracen or Moor; there is much of Eastern culture in his courtly manners, and of Asiatic modes of thought and

expression in the highly educated Argentine of to-day. Basques and emigrants from northern Spain are to be found on both sides the Andes, although they probably predominate in Chile; but amongst those of high social degree, the few who can boast of being pure Argentine, I have often been struck with that peculiar air of courtly distinction which is noticeable in every sheikh and chieftain of the eastern Arabian coast. The Chilean is of harder material. His boast is of an ancestry to be traced through Peru to the early mariners and conquerors of the new world, and although centuries of admixture have modified the original characteristics of his race, and a comparatively free intercourse with the Araucanian Indian stock has introduced new



A PEAK IN THE BAGUALES.

and recognizable features in his composition, there is an atmosphere of solid, straightforward business capacity about the Chilean which appeals directly to the business-minded Britisher. His love of nature is the result of his environment. Amidst such abundant evidence of nature's most glorious conceptions, it is impossible that he should remain untouched. With race proclivities that are almost Anglo-Saxon in their character, and (it must be confessed) with an unæsthetic temperament, the Chilean is, nevertheless, gifted with a happy appreciation of the gifts which nature has so lavishly bestowed upon him. Santiago is a city set by nature's hand amidst scenery of surpassing loveliness. On the other hand, no city in the world can boast with such justifiable confidence of the cultured beauty of its surroundings as the Argentine

capital, Buenos Aires; but this is a comparatively new creation, and it is due to the genius of M. Thays, the distinguished director of the Botanical Department, who spends his life in making gardens from the wilderness with magnificent success.

But we had little time to spare for æsthetics, and midnight of March 5 found us making our way across the still waters of the harbour of Valparaiso (cheered with a right cordial send-off from that most English of foreign townships) to the cruiser *Zenteno*, which the Chilean Admiralty had kindly placed at our disposal. The republic of Chile is as much a child of the sea as England herself. The scent of salt water pervades the whole atmosphere of that narrow stretch of country winding along the eastern edge of the Pacific. Chile believes in herself both as a military and a naval power; but her pride is in her ships, and her most stirring records, her best-loved heroes, are all of the sea; and these records are still so recent that men can stand and talk with you, and say, "I was there, and took my share in them." Captain Wilson, who commanded the *Zenteno*, had been in the historic fight between the *Esmeralda* and the *Huascar*, when the gallant Prat was killed on the *Huascar's* fore-deck. The *Esmeralda* went down, and Wilson went with her. Commander Gomez on the *Zenteno* was with the *Blanco* when she earned a title to figure in naval text-books as the first ship that was ever sent to the bottom by a Whitehead torpedo. This was in Caldera harbour in April, 1891. And there was many another mariner on that cruiser who had his own tale to tell of exploits on the Chilean seas; and the whole sum of such tales and the pride that is born of them, the confidence that is engendered thereby, would form the moral backbone of any naval power. We in England know what it means.

By the 12th we had crossed the Gulf of Peñas, had passed Wager island, the scene of the historic wreck 150 years ago immortalized by John Byron, and steamed down the Menier straits between stupendous rows of granite cliffs and headlands with deep, dank vegetation massed on the water's edge. Here and there we skirted the opening to one of those deep inlets which strike into the heart of the Andes, and jostled against the little icebergs which were dropped from the seaward end of glaciers resting on the mountain folds. The constant humidity of the Pacific coast, due to the perpetual flow of cloud-drift against the mountain-tops, and the extraordinary prevalence of westerly and north-westerly winds, results in snow-formations on these comparatively low cordilleras at altitudes much lower than is usual in such latitudes. I reckon the line of perpetual snow on the seaward or Pacific face of the Patagonian Andes to be about 4500 feet, whilst glaciers are to be seen pushing their snouts into the sea at several points between the parallels of 40° and 50° S. The magnificent effects of Patagonian coast scenery is usually much

discounted by the incessant prevalence of mist and rain; but every now and then the damp dark cloud-drifts roll up, and, gradually thinning outwards with long white fleecy folds, presently wrap themselves solidly around the volcanic peaks, leaving all lesser lines of landscape free. Then we could mark the outlines of the Cordillera from the Pacific coast, and beyond the matted dark-green forest which occasionally overshadowed the ship we could see into the drifts and passes of the hills where the grey-green glaciers parted the granite cliffs. Once, indeed, on our return voyage up the straits, we were favoured by three absolutely clear days, when a scene of almost startling magnificence was opened out. From north to south we could

LAKE SAN MARTIN.

count the gleaming white pinnacles of five great volcanoes beyond a vista of rock-bound, jungle-covered islands of ragged black ridges reaching above the forest growth, and of line upon line of blue-grey sierra and the shimmering streaks of icefields and glacier.

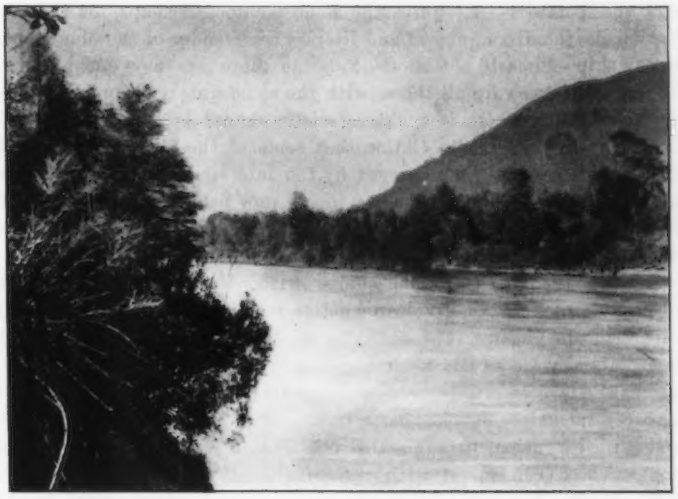
On the upward voyage we examined the deltas and harbours of the great rivers that pierce the cordillera, of the Calen or Baker channel, of the Aysen, of the Yelcho (known as the Ftaleufeu on the Argentine side), of the Reloncavi inlet and Cochamo river. It is from these points that roads have been constructed through the forests, following the main lines of the river channels into the interior of Patagonia. It is by means of these routes alone that Chile can gain access to the interior from the coast. Ten or fifteen years ago they were unknown; to-day

they are rough but practicable lines of communication, liable at times to interruption from snow and floods, but still capable of answering the early purposes of colonial development. These roads seldom touch the actual Pacific shore, and seldom broaden out into more than a jungle-cleared path rendered passable to Chilean mules and Chilean ponies by a "corduroy" system of planking, which consists in laying rough-hewn logs side by side over such parts as would be absolutely impracticable otherwise from the periodic depth and consistency of the mud below. The impassability of Patagonian mud is proverbial. You cannot walk through it, and it takes a sturdy mule to carry you through. More often than not, it is caused by the burrowings of a tailless rat known as the tucu-tucu. Acres upon acres—amounting to square miles even—of otherwise sound and wholesome ground are undermined by this indefatigable little pest; he holds the country as nothing else holds it, until the advent of sheep or cattle (which he hates) induces him to shift the scene of his nightly labours.

The deltas and estuaries of the great Patagonian rivers have much in common. There is seldom anything that deserves the name of harbour close to the river mouths. Ships drawing 20 feet have to find anchorage at a distance. Small boats creep in over the dangerous bars and up the shallow estuaries with difficulty, and in times of flood find it almost impossible to make headway against the rapid stream. The lower reaches of these rivers are usually wide openings in the hills—broad enough to exhibit indications of the periodic changes of the river channel, which in some cases are very marked. The continuous rush of flood water, carrying with it snags and uprooted trees, with tons of alluvial detritus, gradually tends to build up narrow banks alongside the main channel, which rapidly become covered with a dense vegetation. So narrow are these river-fringes of solid soil, that it not infrequently happens that a few yards only separate the edge of the broad and rapid flow of the turbid main stream from the swamps which lie beyond and about it, extending perhaps for miles to the foot of the hills on either side the valley.

Climbing with great labour through the dense undergrowth clothing the rocky sides of a spur jutting outwards to the river Baker, and looking eastward up the great central depression in the mountains which forms its valley, it was easy to mark the ancient channels of the river through the flat swamps on the further side. The old forest growth still held in ragged patches along the lines of the old deserted banks curving in graceful contours through the flatness of the valley bottom. These embracing swamps are frequently quite impassable, and quite useless for economic purposes, and they further present such difficulties to road-making that it is usual for the first "bodega," or group of shanties denoting the commencement of the road into the interior, to be many miles away from the coast, placing an intervening distance of water-

carriage for 10 or 20 miles between the harbour and the road head—a distance which may represent the labour of days rather than of hours of rowing against the stream. All these great rivers are subject to narrows, or "angosturas," in their upper reaches, which render them unnavigable. These narrows are occasionally caused by the occurrence of local mounds and hills in the breadth of the valley rather than by the closing in of great mountain masses on either side. Seeing that it is only within the last few years that any attempt has been made by Chile to open up practicable communication with the interior, it is no matter of surprise that until we arrive as far north as the Reloncavi inlet, near Puerto Montt, where there are considerable and flourishing settlements,



RIVER AYSEN.

there is not a sign of habitation in the recesses of those primæval forests which everywhere cover the western slopes of the Patagonian Andes. I will not enumerate the varieties of forest growth. The most conspicuous trees, perhaps, are the Patagonian beech and the aromatic laurel about the Aysen, where fuchsia and myrtle are intertwined in thick undergrowth with dwarf bamboo and creepers of remarkable beauty; where ferns are massed in graceful splendour along the river-edge, and the huge leaves of the Pangue (with the shape of a gigantic rhubarb leaf and the shade capacity of a large umbrella) make a shelter in the thick dark moss for living creatures innumerable, amongst which mosquitoes are conspicuous for their size and ferocity. It is sufficient to say that on the western slopes of the southern Patagonian Andes there

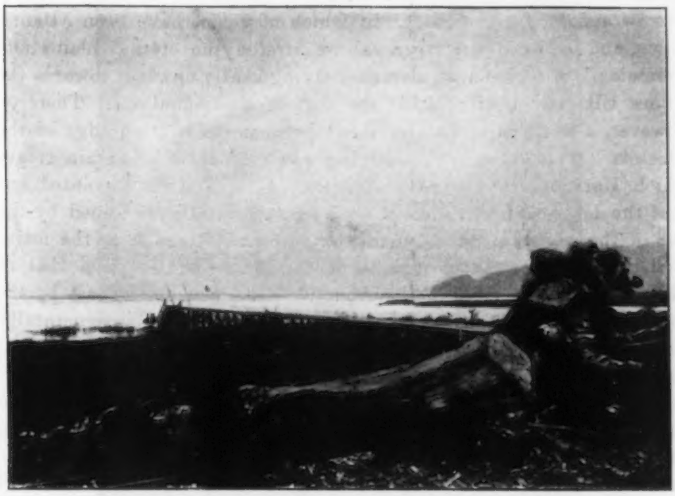
is little timber to be found of commercial value. Further north, where cypress and pines of magnificent girth exist, there is the prospect of a useful timber trade. But the trade is not new. It has been carried on by the Chilotis from time immemorial. It was, at any rate, in existence one hundred and fifty years ago, when Byron spent an enforced holiday in Chiloe; and the swinging sails of the Chiloti craft are still to be seen off the western coast, making a welcome break in the monotony of sea and sky and dark forest-clad mountain-side. Chiloe is a charming island. All the cordial hospitality and the old-world reverence for monarchy (I believe they still talk of the king in Chiloe, meaning the King of Spain) which Byron found one hundred and fifty years ago is there still. Still the same inbred love of the sea, the same pigs and potatoes (not quite the same potatoes, perhaps, for Captain Maldonado, the distinguished and literary commander of the Magellanes survey ship—himself a Chiloti—tells me there are now one hundred different varieties) are all there, with the same untidy, happy-go-lucky methods of life, which is a characteristic shared by the Chiloti with the Irishman. It was to Chiloe that some of the Grimsby fisherfolk who were left out of employment by the late strikes were induced to migrate, with a view of inaugurating a new fishing trade. I hear it was not altogether a successful venture. The fish are there in abundance, but there is an insufficient market.

I cannot leave the Pacific shores without a reference once again to the living evidences of volcanic action which are so marked in every feature of the coast. It would seem as if this broken edge of a deep Pacific abyss were locally subject to waves of motion tending to alternations of elevation and depression almost like the waves of the sea. The great central valley of Chile is to be traced to the south of its extreme landward extension through the remarkable series of longitudinal straits which connect it with the Straits of Magellan. But there is one notable break in their continuity—a break which occurs to the north of the Gulf of Peñas, where the peninsula of Taytao is united to the mainland by a narrow isthmus just above the lake San Rafael.

The lake itself is a remarkable feature, for it is described by Dr. Hans Steffen, the great Chilean explorer, as held in the embrace of an enormous glacier which scatters icebergs over its surface. This, considering that the lake-level cannot be much above that of the sea, and the latitude is less than 47° S., is a remarkable evidence of those peculiar atmospheric conditions which lead to the formation of masses of snow and ice at comparatively low levels on the Pacific border, and assist the cordillera to present all the appearance of a formidable Alpine barrier where there exists but little of Alpine altitude. Immediately south of this land-link which breaks the longitudinal sea-water connection at the head of the Gulf of Peñas, forests are to be observed below the surface of the sea, where the yet standing trees testify to recent

depression. At other parts of the coast the sea-level marks on the rocks are to be distinguished well above the existing high-water mark, equally testifying to a quite recent elevation. Indeed, there is historic evidence for very extensive alterations in coast-level of so recent a date that we may suspect that this region is still subject to periods of oscillation, although data is wanting to enable us to connect the movement with any action on the part of those volcanoes which are still active.

One of the recently partly developed routes across the line of the Andes south of Nahuel Huapi is that which we encountered at the head of the Reloncavi inlet, usually known as the Cochamo route. Two passes are involved, one at the eastern end of the route



MOUTH OF THE YELCHO.

before dropping from the highlands to the south-east of Lake Nahuel Huapi into the river Villegas, and the other after passing from the valley of the Villegas to that of the Manso, and following the length of that river, at a point where a comparatively low water-parting separates the Manso valley from the head of the Cochamo. Neither are of any considerable altitude (from 3000 feet to 4000 feet), but both are occasionally blocked with snow. A certain amount of traffic in cattle is already established along this road, no transfer from land to sea transport being necessary in order to bring this traffic into the well-populated districts of southern Chile bordering the Lake Llanquihue, where there are many German settlements. Parts of the Cochamo road are, however, very bad, and will require considerable engineering skill to render them invariably passable.

Argentine Patagonia, extending southwards from the river Negro, consists for the greater part of its area of wide, gently shelving stretches of Tertiary formation, which, reaching westwards from the Atlantic coast, are the remains of a once far wider continent now submerged in the ocean. Beneath its pebble-covered surface (here and there sheeted with lava-beds) are the bones of thousands of generations of extinct mammals, certifying to the pre-historic extension of the continent eastwards. Pampæan palæontology forms almost a new branch of geologic science. An ancient—very ancient—and now disintegrated range traverses these Tertiary plains, and now and then crops to the surface in the form of granite ridges. East and west across the Pampas plains great rivers drain from the Andes to the sea in comparatively narrow and fertile troughs, all of which may once have been Atlantic inlets, and between the river valleys stretch the eternal plains and "mesetas" (or tablelands), always shelving gently upwards towards the Andes till they nearly touch the foot of the mountains. There is, however, a frequent break and a fall between the western edge of the "meseta" terraces and the outlying spurs of those mountain ridges which Moreno calls the pre-Cordillera. I have already pointed out that the long central valley of Chile is structurally continued by the line of the western straits, separating the archipelago from the mainland. The great central Andine depression, separated from that of Chile by the main mass of the Andes, and flanked on the east by the detached ridges and sierras which overlook the Pampas, is structurally analogous to that of Chile. It is the most important geographical feature of Patagonia. Herein lay the disputed tracts; here are glacier-fed lakes amidst granite mountains, undulating downs of morainic formation, wide grass valleys eroded and dotted with erratic boulders, magnificent forests, eternal snows, and stupendous cascades. Commencing as far north as 38° S. lat., this region of depression may be traced to 50° S. lat., where it buries itself beneath the sea. The creation of its landscape is in eternal progress. Slow processes of upheaval and subsidence now take the place of the volcanic cataclysms which must have torn and altered it through the whole Tertiary period. In the farther north the remains of man and of animals are found lifted up on high through thousands of feet to an elevation and climate which they never could have endured whilst existing; whilst forests are to be traced below sea-level, as I have already said. The result is that abnormal division of the drainage of the continent which has proved such a perplexing feature to the treaty-makers of Chile and Argentina. The constitution and value of the Patagonian Pampas for economic purposes is variable. Vast areas are unproductive, and seem likely to remain so, but I doubt whether any part of them is absolutely barren and devoid of the small wiry tufted grass which is so characteristic of all indigenous South American pasturage, or whether there is any part of them

where water would not be obtainable by artificial means. To the south, bordering the Santa Cruz and Gallegos rivers, colonization has commenced with vigour. Square leagues of pasture land have been allotted to enterprising farmers, and thousands upon thousands of sheep now graze within well-fenced acres. But there does not appear at present to be any great natural development of indigenous grasses such as has met the demands made upon it by cattle in the rich provinces of Buenos Aires and Santa Fé. I have never heard any satisfactory

COCHAMO ROAD, NEAR RELONCAVI.

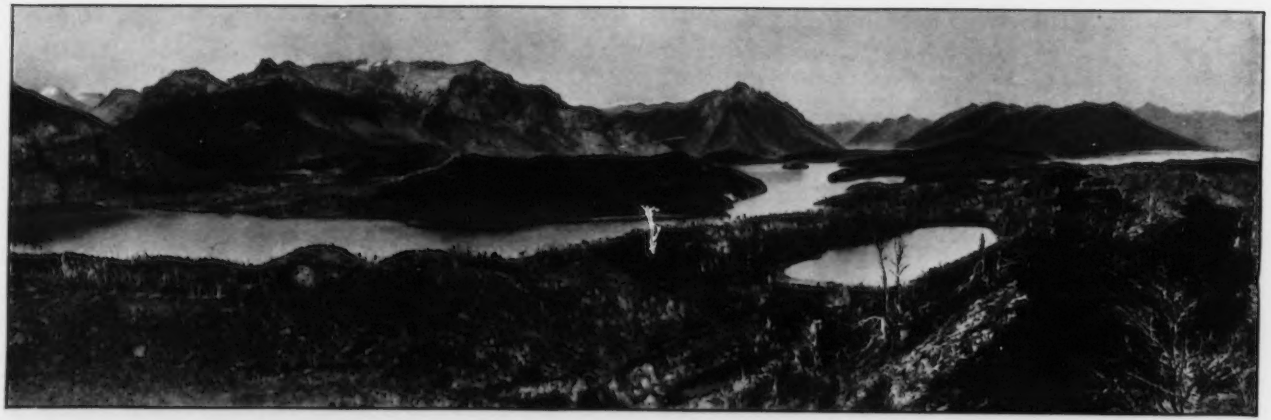
explanation of the important fact that the introduction of cattle to grazing-lands, where originally there was nothing but the tufted "stipa" (to adopt a local name), has elicited a response from nature in the form of a matted growth of the richest grass that is known in the world of pasture land. It appears to be a new feature—a new quality of pasturage which is not always to be accounted for by the artificial introduction of new seed. Whether this is to be in future a universal feature in the development of Pampas country, I cannot tell.

Farther south one finds on Terra del Fuego and in the Magellanes district adjoining Last Hope inlet, a natural growth of pasturage which is excellently adapted to sheep-farming, and there already great sheep-runs have been parcelled out, and the wool trade is growing to importance. I know nothing more beautiful than these far southern farmlands in the Magellanes territory—the Scotland of South America. Long sweeping undulating downs climb upwards to the forest-clad hills, or down to the edges of the blue glacial lakes; and through the mazes of the blackthorn bush which spreads over their folds, filling the air with its fragrance in flower-time, the startled sheep race away like deer, often accompanied by long strings of the ostrich or rhœa, which sagacious bird has already discovered that living amongst sheep which are never hunted is a useful alternative to hiding its head in the sand as a refuge from its enemies.

To the west, shrouded in a mystery of storm-clouds and Pacific mists, are the granite and slate peaks of Painé and Balmeceda; northward, across the horizon, the castellated and broken outlines of the Baguales stretch their length across the landscape; whilst all around are the sandstone hills, cliff-bordered, forest-covered, where swarm the huemul stag and the mischievous puma, with grassy slopes, and rifts and gullies where the calceolaria bunches itself in yellow tufts on the mossy banks of turbulent streamlets. It is altogether lovely in colouring, in outline, and in its infinite variety; and I know no fate happier than that of the few enterprising English, Scotch, and German farmers who make this region their home. Remember that ten years ago no settler had ever seen this land of promise.

But we must turn now from the Patagonian plains to the Patagonian Andes, and trace in brief outline our route through the heart of them, where the boundary now runs between Chile and Argentina.

Striking southwards from the lake of Nahuel Huapi (one of a series which we passed by on our journey from Puerto Montt, as we recrossed the Andes from the Pacific to Argentina by the Perez Rosales pass), we crossed the continental divide between the Curruleufu river and the Villegas, and dropped into the basin of the Manso. Before proceeding farther, let me say a word for the lakes we are leaving behind us. I have seen many lakes in many countries, but never one to rival the beauty of Todos los Santos, of Frias, or of the western arms of Nahuel Huapi. If one could fit the splendid snow-cone of Japan—Fujilama—into a position of dominance over the Lake of Lucerne, then, perchance, something of the entrancing loveliness of outline combined with the majesty of mountain mass enfolding the deep-set waters of the lake of Todos los Santos, might be given to the sweet lake of Switzerland. But I doubt if even the snow-cone of Japan can rival that of Osorno. Beautiful as are these Andine lakes, I regard them as fatally adverse to



PANORAMA OF LAKE NAHUEL HUAPI FROM PENINSULA DE SAN TADEO.

the establishment of any great permanent commercial highway between Argentina and Chile at this point of their common frontier. Porterage

LOADING MULES ON THE PAMPAS.

between them, and the constant change from land traffic to water, have hitherto precluded the Perez Rosales pass from rising to commercial importance, and will continue to do so. North and south of Nahuel Huapi there are much easier lines of communication across the Andes, some of which will certainly develop rapidly in the near future. In the basin of the Manso we were on one of them, the Manso valley indicating the route. I have already referred to its western outlet by the Cochamo affluent of the Reloncavi inlet, but this route need not necessarily end at the sea. It will doubtless eventually be carried by a northerly *détour* crossing the head of the inlet to the settlements of Llanquihue and Puerto Montt, and thus form one continuous line of fairly open road from the Rio Limay of Argentina to the base of the Chilean central valley; through the whole length of which valley there will soon be railway communication. There is already very considerable cattle traffic passing this way across the Andes, and it is bound in time to become an important road. The Yelcho route farther south may also prove important in the future. The harbour is the best on the southern Pacific coast, although it is at some little distance from the river mouth, and the Yelcho route leads direct to the promising valleys of 16th October, Cholila, and Corcovado. No passes of any altitude are involved in the route from the head of the Yelcho to the plains east of

the Andes. From the Manso basin, where we were for a time cut off from communication with the outside world by the persistent downpour of early winter rain, which flooded the rivers enclosing our camp, we travelled south over the flats and terraced depressions intervening north of the valley Nuevo. Swamp and what is locally known as "pantano," which is usually a treacherous bog caused as much by the undermining propensities of the tucu-tucu as by ordinary morass formation, absolutely barred our passage down this generally open grass valley, and we were forced into an easterly *détour* which carried us along a part of the Maitén affluent of the Chubut river.

From Maitén we struck once again into the lowlands at Cholila, and, crossing a low divide, reached the valley of the 16th October. The valley of the 16th October is the most promising field for colonial development which has fallen to Argentina by the virtue of the King's award, and it is of unusual interest as being already occupied by settlements of Welshmen, offshoots from the larger Welsh colonies in the Chubut valley. Thirty years ago this band of Welsh pilgrims founded for themselves a home in the Patagonian wilderness, where they should neither hear the detested English tongue nor be subject to English influences. They left their homes amongst the Welsh mountains impelled by a spirit of semi-religious conservatism not

LAKE NAHUEL HUAPI.

altogether unlike that which animated the pilgrims of the *Mayflower* before them. For thirty years they maintained their position in the

land of their adoption, fighting their own battles with Indians and the hostile influences of nature alike, until they had redeemed the Chubut valley from its wildness, had brought water into its waste places, and had learnt to grow the finest wheat in Argentina. Meanwhile they had advanced physically in a most extraordinary way. The Welshmen of Chubut are a strong, sturdy race of colonists, exhibiting all the characteristics of well-developed manhood. This, as you know, is not exactly the case in Wales. But the world around them developed even more rapidly than themselves. Not long ago they found themselves politically included as an Argentine people, subject to Argentine laws,

LAKE NAHUEL HUAPI ON A BREEZY DAY.

to conscription, and—what especially touched their religious sensibilities—to drill on Sundays. And they had other grievances, no doubt—grievances analogous to those which they had come to Patagonia to avoid. But it must not be supposed, therefore, that the deputation which interviewed our Colonial Secretary not so long ago, and sought his influence and assistance to enable them to reach new colonies in Canada or elsewhere, really represented the views of the colony generally. They raised much sympathy in England, but they did not represent the spirit of the colony they left behind them. All the same, the colony was glad enough of the relief afforded to their overcrowded Chubut settlements. The fact is that they want more room, and that they must accept the inevitable and spread abroad like others have done. The younger generation are quite aware of this, and quite

prepared for it. This little offshoot in the sweet valley of the 16th October knew nothing of this Chubut agitation. I believe I was the first to tell them. Amid the softly rounded grass downs of the valley, where their neat little cottages dot the slopes as they might in Monmouthshire, they live contented lives, making a living from their produce, but hardly growing rich, and their one great hope (a hope which, I trust, has ended in fulfilment) was to possess a title to the lands which they held, a title which would justify expenditure in building, planting, fencing, and cattle-rearing. Welsh and Spanish are the recognized language of the colony, but most of them can talk English perfectly well. I shall not soon forget the warmth of my welcome amongst these people. The colony (as it is known locally) undoubtedly holds, within the limits of a somewhat restricted valley flanked by forest-covered mountains, the greatest promise of future development of any of the newly acquired Argentine Patagonian settlements, and its direct connection with the Chubut and the coast ports of the Chubut gives it an accessibility which is wanting elsewhere.

The value of these scattered groups of settlements along the length of the Andes turns quite as much on the nature of their communications with ports or markets as on their own inherent productiveness. There is no doubt about the general suitability of the grass lands of the central Andine region of Patagonia for pasturage. They are peculiarly well suited for cattle-farming, but the transport of wool or of agricultural produce is a difficulty which must be expected for many years to come to bar the way to developments of which they are undoubtedly equally capable as wool-producing or corn-growing tracts.

The autumn was rapidly closing, and the early signs of a severe winter were not wanting, as we made our devious and difficult way through these mountain spaces. The most conspicuous, if not absolutely the most prevalent, form of vegetation which clothed the mountain-sides and filled the gullies of the lower slopes was the Patagonian beech, and, excepting perhaps the North American maple, there is no vegetation which adopts such splendid hues in autumn. We wandered through woods which were a blazing harmony (if that be possible) of scarlet, purple, and orange. The tints of the autumn-painted woods spread themselves in brilliant interlacing threads from the banks of the stream at our feet to the foot of the snow-line of the rugged sierras above our heads. It was as if the mountains were hung with vivid sheets of oriental carpeting. Scarlet and gold faded to purple in the distance, and could be traced in bluer, fainter, lines to the foot of the grey granite cliffs, above which hung the white masses of snow-cap. Over all was there usually a dull grey sky and the white streaks of mountain mist, but variation was the keynote of Patagonian weather. Drenching rain, blinding fog, or thick grey snowstorm might alternate with clear deep-blue sky patches and fleecy clouds, with

shafts of sunlight athwart the hills, making a golden glory of the woods and hanging deceptive rainbows across the valleys. Rising barometers and rainbows only indicated more rain. Yet as we journeyed further

A TYPICAL ANDINE VALLEY, PATAGONIA.

south, following more or less the line of the continental water-parting from the colony of 16th October to Corcovado, and thence rounding the northern affluents of the Senguerr river to the upper Mayo, and so to the borders of Lake Buenos Aires, we enjoyed many an interlude of bright but breezy weather between the westerly gales which began to set in with systematic vigour. We were constantly wet, and often cold and weary, but we were never ill. If the weather on the whole is untrustworthy, the climate is magnificent. We had no medical accessories whatsoever, and nobody thought of them. The vigour of the wild west winds sweeps all evil influences off the face of Patagonia, and the vicissitudes of weather become but matters of passing interest. But snow was massing itself gradually on the mountains long before we had reached the Koslouski settlement north of Lake Buenos Aires. We had reason to know what winter gales would mean, and perceived the necessity of turning westwards to the coast. Luckily, Captain Robertson (who had examined the southern section of the country through districts as wildly magnificent as any that we had seen, and perhaps even more inaccessible) was within a measurable distance of our last Andean camp, and arrangements could be made for beating a retreat to the port of Rivadavia, in the Gulf of St. George.

We left the Andes in as blinding a snowstorm as I have ever

experienced in the far country north of India; it was only by following close in single file, treading silently in each other's tracks, that it was possible to keep together, and from the day we left to the day we reached the coast we were never free from the possibility of being snowed up *en route*. The almost daily hurricane of westerly wind which speeded our departure helped us across the continent in no ineffective measure. It would have been impossible to travel in the teeth of it. The cold was often intense, but I had, unfortunately, no minimum register for purposes of record. We were once snow-bound, and, having lost our way, we had to pitch camp on our tracks; but, as a rule, the Indians, who guided us when no tracks were visible, were unerring in their calculations as to distance and time. Halfway across the continent we met the telegraph constructors, making rapid progress westward to the colony of Colhuapi and Musters. It was a curious coincidence, which I have mentioned elsewhere, that the first message delivered to me as I rode into camp was "Peace signed with South Africa," and almost the next told of the agreement between Chile and Argentina. I cannot sufficiently express my gratitude to the telegraph officials of Buenos Aires for their courtesy in giving me a free line for an hour or so each day, so that I might be well posted up in the latest news. Nor is this the place to tell of the pleasant days passed at Buenos Aires. I have often heard it said that Englishmen are unpopular in Argentina. Officially and socially I received so much kindness, so many evidences of a friendship that was genuine, and will, I hope, be lasting, from all sections of

INSCRIBED STONE, COLONY OF "16TH OCTOBER."

Argentine society—from President and people—that it is quite impossible for me to endorse such a verdict. I do not believe that the English as a nation are unpopular, whatever may be the case with individuals. I think that we are trusted in South America, on both sides of the Andes. Certain political events which transpired whilst in that country fortunately tended to establish a confidence in England's political honesty which had perhaps been a little shaken by the Boer war. I am no politician, but I have little hesitation in attributing the successful attainment of the boundary settlement to the firmness and statesmanship of the Presidents of the two Republics, who were unanimous in their efforts to secure peace and good-will between the two countries, and spared no pains to assure me of their support in the arrangements which I proposed for securing a delimitation rapidly and effectively. The prestige which distinguishes General Roca as a soldier, no less than his great ability as an administrator, has already secured for him the unusual honour of a double period of presidency. Probably no country in the world's history has made such strides in material advancement as Argentina under President Roca's administration. To President Riesco of Chile I owe an equal debt of gratitude for his personal kindness and support throughout my investigations. Failure was impossible with such practical assistance as he gave me. I know no more delightful city to visit than Buenos Aires; I know no more beautiful country than the *entourage* of Santiago. If I had time to speak of the future, of the magnificent field for agricultural and commercial development afforded by Argentina, or of the yet latent possibilities that lie unexploited in the heart of Chile, I should like to speak of these southern states as a whole and undivided, as supplementary one to the other, as combined in an all-peaceful enterprise to establish a new and powerful factor in the development of the world of nations.

Before the reading of the paper, the CHAIRMAN (Colonel G. E. CHURCH, Vice-President) said: It is our good fortune to-night to have with us our colleague Sir Thomas Holdich, who has been doing work in South America eminently conducive to the peace of that part of the world, and we also feel that this evening we are to have a paper read by a gentleman thoroughly able in all that appertains to the knowledge of orography, of wide experience in North-West India, and now in Patagonia, a region of the world which in my youth I used to regard as the dumping-ground for the surplus manufactures of Nature. I call upon Sir Thomas to read his paper.

After the reading of the paper, the following discussion took place:—

Dr. J. W. EVANS: I have very little to add to the magnificent paper we have heard to-night. I am sure the Society ought to be warmly congratulated on having such a paper before it, especially for the interesting and graphic description we have had of this magnificent meridional valley which runs through the whole mountain region of Patagonia from north to south to the east of the main heights. This region has only been, so to speak, disclosed to the outside world during the last

ten or fifteen years, and yet, unlike most newly discovered regions at the present day, is neither a sandy desert, an arctic waste, nor a tropical forest, but a country possessing a temperate climate, and having perhaps the most magnificent scenery in the world; a country, too, of which there is every reason to suppose that one day —not perhaps very far distant—it may be populated by as sturdy and intellectual a race as inhabits any part of Europe. There is, perhaps, one small point on which I may comment. Sir Thomas Holdich distinguished between the regularity of the Andes in the other part of the chain and the tremendous amount of variation in the direction of the ranges and other irregularities which occur in Patagonia. I think that the regularity which most people associate with the Andes in other regions exists rather in the maps than in Nature. The more we know of the Andes, especially in the state of Ecuador, the south of Colombia, and the north of Peru, and indeed the eastern Andes throughout the greater part of Peru, the more we realize that in many places, instead of being a regular chain, they are a system of peaks in which it is very difficult to find any succession at all. I think we may especially congratulate ourselves that the lecture we have had to-night is one by a traveller who has perhaps seen more of the great mountain masses of Asia in the Himalayas and Afghanistan than any other man in the world. He has now taken up a new ground for his explorations, and nothing is more interesting than to hear the impressions of a man who has had such wide experience. I can only hope that some day circumstances may direct Sir Thomas's attention further to the north to the great plateaus high above the sea, where the conditions are similar to those with which he has been so long acquainted in Asia. There, too, there are frontiers to be delimited, and I think the states on either side of these undetermined frontiers will be fortunate indeed if they secure the services of Sir Thomas Holdich to mark them out. Then once more will he at the same time do an inestimable service, not only to the cause of geographical science, but to that of peace and international harmony and concord.

The CHAIRMAN: In connection with Patagonia, it would be ungracious to forget the name of Charles Darwin. He it was who first attracted the marked attention of the scientific world to the wonderful geological changes which had taken place in that remote portion of the Earth, and I think I am justified in calling upon Major Darwin to-night to give us a few words regarding what has been done there by his father.

Major DARWIN: I must thank you for your very kind allusions to my father's work in South America. When he went there he was quite a young man, and really an inexperienced man in geographical work, and I cannot help feeling it is a satisfaction to learn from Sir Thomas Holdich that, notwithstanding all the years that have passed since he did that work, his views are still generally accepted. I am certainly not in a position to discuss those views, and I would only like to say that I am quite sure that my father would have been perfectly ready to abandon those views if it had been proved by subsequent explorers that other views were more in accordance with the facts; but that they have not been abandoned is certainly a satisfaction to me. But I do not wish to speak so much of my father as of Sir Thomas Holdich this evening. We English people all know, and know only too well, that arbitrations have generally given dissatisfaction to both sides, and I think always to one side. Now, Sir Thomas Holdich has had the very great satisfaction of dealing with an arbitration which, as far as I know, has given, generally speaking, satisfaction to both sides—and that is a marvellous performance. I had almost said Sir Thomas Holdich had had the luck, but it is no matter of luck; the problem was a geographical problem, and his Majesty, if I may say so, was well advised to appoint on the commission an eminent geographer like Sir Thomas

Holdich. And when a geographical problem is dealt with by a geographer like Sir Thomas, it is not a matter of luck that the award gives satisfaction on both sides. I hardly think that we of the Geographical Society have taken sufficient note of the fact that one of our Vice-Presidents has been dealing with this extremely important problem, and has dealt with it so admirably. We may congratulate Sir Thomas Holdich on his paper to-night; but I think we may congratulate him on something far more important than that. I do not think there is any deed whatever of which a man should be more proud than having helped to maintain peace between two important countries, and having, to a certain extent, helped to turn hostility into friendliness, and that is a pride which I think Sir Thomas Holdich may have.

Señor VICTOR EASTMAN: I thank you for the honour of calling upon me to make a few remarks in connection with the important paper which Sir Thomas Holdich has read to-night. I must admit that I was not prepared to be honoured in this manner. Still, in connection with the paper, I am afraid I have very little to say, save that it is worthy of a distinguished geographer. But before I take my seat, there are two points upon which I wish to speak—first, the kind allusion to our navy; many of you know that our first lesson in naval affairs was received from a British officer, the undaunted Lord Cochrane; then, again, many of our officers have received their finishing touches on British decks: and, secondly, to thank Sir Thomas Holdich for his kind remarks on His Excellency Señor Riesco, the President of Chile. It will be, I am sure, agreeable for him to know that his name is revered in Chili very much indeed, and it will always be gratefully remembered there.

The CHAIRMAN: There is but very little that I can add to the interest of this occasion, and the compliments which have been paid to our friend Sir Thomas Holdich have been not only well deserved, but well earned. We feel especially honoured that a Vice-President of our Society should have been selected as a peacemaker between Chili and the Argentine Republic—the very hope, the very focus of South American advancement; the one on the Pacific side of the continent, the other on the Atlantic. On the Argentine side there are no less than 250,000,000 sterling of British capital involved in the peaceful development of the country, and in Chili English capital has been poured in with great liberality for the working of its mines, its agricultural and pastoral resources. Therefore, had war taken place between these two important countries, it would have meant, not only an immense financial loss to the world, but the sinking of the hopes regarding South America perhaps for a century. The states to the north of Chili and the Argentine are yet making their way up from the misery in which Spain left them, and now, just as they are emerging from that condition and showing their capacity for self-government, when they are producing men of the highest intelligence, far-seeing energetic people, we ought by all means to encourage every effort that can be made for good fellowship and goodwill. I understand, from the paper which we have heard, that President Riesco and President Roca have lent all their energies to the preservation of peace; that Sir Thomas has been aided abundantly by the admiralties of both countries, and by their telegraphic departments; that, in fact, neither expense nor effort has been spared which in any way could aid his mission.

A few words, perhaps, regarding the geography of the Andes. The double range, which spread out in Bolivia to a width of about 500 or 600 miles, holding in that space plateaus, 14,000 feet elevation, suddenly close in from the east and unite at Mount Aconcagua, that giant peak, 23,080 feet high. At about 33° of south latitude thenceforward the Andes are only a single chain, and it is interesting that at this point there is the transverse barrier of Chacabuco, which runs from the main range

to the coast sierra. On the north of this the country is arid as far almost as the equator, but south of it commences a moister belt, and from Santiago down to about lat. 41° 30′ you have that very beautiful valley which lies between the main range of the Andes and the Pacific coast sierra, which is one of the most beautiful valleys that I have ever travelled through in South America. At the latitude named, it dips under the ocean, and we then have the remains of the coast sierra extending down to the Straits of Magellan, and numberless inlets and every imaginable deviation of ocean and river, which make the coast of Patagonia such a wonderful field for scenic effect. On the east side of the Andes, we have what Darwin has said is one of the most wonderful Tertiary and shingle formations in the world. Take it from Bahia Blanca and from about 700 miles south along the Atlantic and 200 miles inland, we have a cap 50 feet thick of shingle, all of which represents some eight successive movements of elevation from the sea-bottom upwards, eight terraces with all their margins well defined as having been on the edge of the sea-shore, but now elevated to from 300 to 400 feet above sea-level. They represent the wonderful denudation of the Andes. If you examine the map, you will find that north of Lake Titicaca there is a transverse barrier called Vilcanota; north of which the rivers flow northward and enter the Amazon. That knot is the governing-key point of Andean geography, and south of it is Lake Titicaca, which is now only the shrunken remains of what was once a lake of 106,000 square miles, which poured southward through the longitudinal gorges of the Andes, and reached the Atlantic at and near Bahia Blanca. Therefore, all that region is perhaps one of the most interesting, not only geographically, but geologically, that can be found in the world, and, as Sir Thomas has said, Nature has been working there on a vast scale. It has thrown out from a hundred fiery mouths volumes of lava, which have given Patagonia a hard basaltic cap of from 300 to 400 and 800 feet thick in places. It has been one of the most active places on the globe as regards igneous action, and almost rivals Ecuador. I will not detain you longer, but it remains for me to convey your very sincere thanks, which I know you will cordially vote, to Sir Thomas Holdich.

THE OROGRAPHY OF ASIA.*

By Prince P. KROPOTKIN.

I. Introductory Remarks.

During a five years' stay in Siberia I made several journeys which offered me special opportunities for gaining an insight into the leading features of the orography of this wide region. In 1866 our small expedition realized at last what had been the dream of the Siberian Expedition of 1860. We crossed in its full width the mountain region which fills up the space between the Lena and the head-waters of the tributaries of the Amur. From Irkutsk we went first northwards to the gold-mines of the Olekma region. We followed the course of the Lena, excavated in the horizontal layers of Red Sandstones, probably

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* Maps, p. 280.

Devonian; * we saw next the great river piercing Silurian limestones, in a picturesque valley, and we entered after that, near the mouth of the Vitim, into a zone of gneisses and crystalline slates, probably Laurentian and Cambrian. There we landed, and at the Tikhono-Zadonsk mine (59° N. lat., 115° E. long.) our expedition was organized for its subsequent journey across the wilderness. We went first southwards, crossing for a distance of 400 miles a wild Alpine region, in which I could distinguish four parallel mountain ranges, running south-west to north-east—the first of them chiefly composed of auriferous clay slates; the second, chiefly of dioritic slates and gneisses; and the two latter, on the left bank of the Vitim, of gneisses, granites, and syenites. Thus we reached the Muya river, which flows eastwards, to join the Vitim, in a broad, deeply sunk valley, which is continued further east by the valley of the Chara, and joins in the west the valley of the Barguzin,—these three valleys having the same orographical character and constituting an important landmark.

Continuing our south-bound journey, we climbed upon a high ridge (over 5000 feet), the soft undulating summits of which already from a distance revealed its granitic structure; and, after a short descent, we were on the surface of a plateau from 3300 to 3500 feet high, which we had to cross for a distance of another 400 miles. It was the plateau which Georgi in the last century, and Lopatin two years before us, had visited as they came from the valley of the Barguzin (Baikal), and to which Georgi gave the name of *Vitim plateau*, which name I, of course, maintain. Following our journey on the surface of this plateau, which is only diversified by a few parallel, relatively low ridges (their bases lying on its high surface), we finally came, at a distance of some 15 miles from Chita, the capital of Transbaikalia, to the north-western foot of a second border-range—the Stanovoi, or the Yablonovoi, which lies on the surface of the plateau. A very gentle and short slope brought us to the flat summit of this range—hardly 600 feet over the surface of the plateau — but then we went down a very rapid and a much longer slope in order to reach the Chita river, which belongs to the basin of the Amur. We had thus obtained a full cross-section of an immense highland, nearly 700 miles wide.

Another journey, which I made two years before, was, geographically speaking, a continuation of the above. Starting from Chita, I went to the Tsurukhaitu Cossack village, in the south-eastern corner of

* Baron von Toll considers them as Cambrian-Silurian, but I must confess that I do not feel quite convinced by his arguments. So long as we have no positive proof, I permit myself to keep to Erman's view, according to which the nearly horizontal layers of Red Sandstones of the Upper Lena lie *upon* the Silurian Limestone of the Middle Lena. This doubt lasts now over forty years. Could not some geologist give a summer to the special exploration of the Lena and the surrounding high plains?

Transbaikalia, now the head of the Trans-Manchurian railway. Thence, disguised as a merchant, with eleven trading Cossacks, I started, to find a direct route, across Manchuria, to the Middle Amur; we followed for about 130 miles the surface of another plateau, which I call now the Lower Terrace of the Great Plateau of East Asia (in the afore-mentioned journey we had reached it at Chita, after having crossed the Stanovoi escarpment). Marching eastwards, we reached, even without noticing it, the crest of the Great Khingan. From the character of the vegetation I knew that we were gradually rising to a higher altitude; but only when we had reached the customary *Obo*—a heap of stones and branches, with small offerings to the gods, usually erected on the water-parting—did we learn that the waters which we saw before us were running towards the Amur. Going now down a very steep slope, we came to the stream Gan, which flows into the Nonni, a sister river of the Sungari. It thus appeared that here, under the 50th degree of N. lat., as well as it was known to be further south (from Timkovskiy's, now seemingly forgotten but important journey), on the route to Pekin, the Great Khingan is, like the Yablonovoi, a border-range which fringes the lower terrace of the great plateau of Asia, and faces, as an escarpment, the plains of Manchuria and China. It is accompanied along its eastern slope by an Alpine region, some 70 miles wide, composed of three parallel chains, which we crossed, following the course of the Gan. Then we crossed the nearly 1500 to 2000 feet high plains of Merghen, and passed over the flat, undulating hills of the Ilkhuri-alin, where we found the renowned volcanic region of the Uyun-kholdontsi, and reached the middle Amur at Blagovyeschensk.

To complete this picture further eastwards, I may add that during subsequent journeys I crossed on horseback the plains of the middle Amur. They spread eastwards as far as the Little Khingan, or Dousse-alin ridge, which separates them from the lowlands of the Sungari and the lower Amur. These latter, which occupy the space between the Little Khingan (or Bureya range) and the Sikhota-alin coast ranges, are, as is now known, the greatest obstacle to the building of a railway along the Amur, on account of their low and marshy character, and (to use Peschel's expression) "the youth" of their rivers, which have not yet excavated quite permanent beds. I also crossed them on horseback, and moreover, in 1864, went on board the first steamer which ascended the Sungari, as far as Kirin, and thus saw the southern continuation of the Little Khingan. Further east we have the littoral chains of the Sikhota-alin, between the Usuri and the Pacific ocean, and the partly submerged ranges which build up the Japanese archipelago, the island of Sakhalin, and so on, and seem to be still in their building-up period.

These journeys gave me consequently a complete cross-section of the highlands of Eastern North Asia, and they were completed by several

smaller journeys of less importance, one of which was made in the Sayans.

However, these journeys alone would have been insufficient for giving me a complete idea of the orographical structure of North-Eastern Asia. As a rule, the true direction of a chain of mountains cannot be determined by one single crossing of the chain, because the traveller who crosses a chain of mountains is always inclined to represent it as perpendicular to the main direction of his route, which is by no means always the case (see Fig. 1). Two crossings, at least, are required. As to the directions of mountain ranges in an Alpine region of complicated

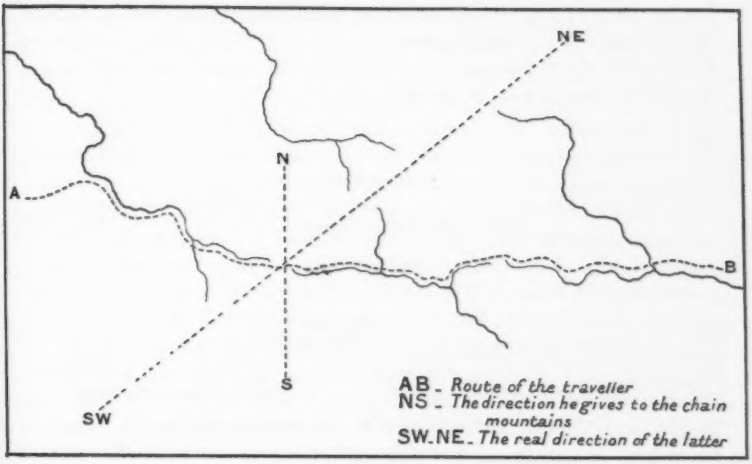

FIG. 1.

structure, they can only be ascertained from a general and detailed study of the region. I had thus to complete my journeys by such a study.*

On the then existing maps of Siberia the whole country was covered with chains of mountains, carefully drawn by the topographers between all the rivers. The darkness of the worms, which were thus represented creeping in all directions, increased in proportion to the importance of the watersheds which they represented. And, finally, a range of very darkly engraved mountains, the Stanovoi Khrebet—"the main

* The few measurements of the dip of the rocks which one can make as he crosses a Siberian highland are (as V. Obrutcheff has quite correctly remarked to Edward Suess) of an extremely small value. Let one imagine taking an occasional measurement of the dip of the shales on the North Cornwall coast, and trying to deduct from this the direction of the foldings of the rocks. On the space of a mile the rocks are found dipping to all points of the compass.

water-parting"—was traced all along the sinuous line which separates the heads of the rivers which flow respectively into the Glacial and the Pacific oceans. This range, as had been already hinted at for some parts of it by Ludwig Schwartz (the head, for many years, of the Siberian Expedition, and the only explorer, with Colonel Akhte, of the Eastern Stanovoi, as also the author of the great map of Eastern Siberia)—this range does not exist in reality. It was born, not even in the imagination of the explorers, but in the map-rooms, where the European topographers, whose education was made in speaking of Alpine chains as of "a prism laid on one of its sides," had traced the highest range of mountains along the main water-parting. In reality, the Stanovoi, as every one may see it now on the railway line near Chita, is only a border-range of the plateau, an escarpment, and the highest mountains of the region are situated elsewhere (Fig. 2, A). In other portions of Siberia the rivers flowing to the two different oceans take their origin in common marshes on the plateau (Fig. 2, B).

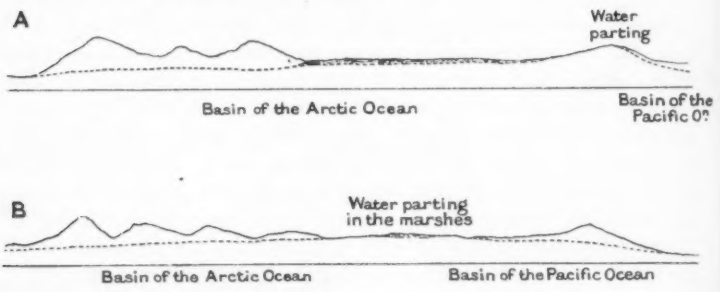

FIG. 2.—WATER-PARTINGS ON THE SIBERIAN PLATEAU.

However, the European topographers, unfamiliar with the plateau type, did not realize such a structure, and when Schwartz intended to represent this type on his large map (27 miles to the inch), they drew, contrary to his indications and sketches, only chains of mountains. Then—he told me that himself—he himself drew the orography as he understood it, on his small map (108 miles to the inch). But the same mistake was now made by the engravers, so that Schwartz told me, "Keep no account of the orography on my maps; find it out yourself."

I had therefore to return to the original itineraries of the travellers. Schwartz gave me all the original meteorological diaries of the members of the Siberian Expedition, as well as his own, very precious, full diary of the Akhte Expedition (1851). Utilizing, in addition to these, all published barometric observations, and those which I had made myself during my journeys, I calculated a catalogue of about 800 altitudes, which was published in vol. iii. of the *Memoirs of the Russian Geographical Society* and in *Petermanns Mittheilungen*. With the aid of these

altitudes I prepared a number of cross-sections of Siberia (part of them is reproduced here, from vol. v. of the same Memoirs). Then, taking all the original journeys, I traced on the large map of Schwartz all orographic and geological remarks which these records contained; and when I saw that a traveller had crossed a range of mountains which had such and such an orographical and geological structure, I endeavoured to discover which of the ranges crossed by other travellers a hundred miles further east or west would best answer to the same structure and character. I proceeded, in short, in a strongly inductive way.

However, as each inductive research is also guided by some deductive hypotheses, I was for a long time working in a wrong direction in consequence of the hypotheses formerly made, especially by Humboldt in his beautiful work 'Central Asia.' The great author of 'Cosmos,' under the influence of the Chinese authors whom he had studied for some time, endeavoured to represent the chains of mountains of Asia as a regular network, in which some ranges were running along the parallels and the others along the meridians; and, quite unconsciously, I tried for a long time to make the plateaux and mountain ranges of Asia fall in accordance with the system of Humboldt.* It was only after a long succession of failures that I saw that Humboldt's hypothesis, which has rendered great service in stimulating research, does not answer to the reality of facts, and I finally came to the conclusion, first, that the mountains of Siberia do not follow meridians and parallels, but have a general direction from the south-west to the north-east, and second, that the mountain ranges are entirely subordinated to the plateaux. These ideas I embodied in a map which represented schematically the great lines of structure in this part of Asia, and of which a reproduction is now given with this paper, and in a 'General Sketch of the Orography of East Siberia,' which was published in vol. v. of the *Memoirs of the Russian Geographical Society for General Geography* (1875), and will be summarized here.

When this sketch and map were published in Russia, in 1875, Petermann was preparing his map of Asia for the atlas of Stieler. He knew my preliminary work, he had encouraged me in preparing my catalogue of altitudes, and he accepted at once my conclusions. He embodied, in his well-known map of Stieler's Atlas, the system which I now proposed for Eastern Siberia, Mongolia, and Manchuria, and it fell in admirably with the more accurate surveys which had just been made at that time in Turkestan and Central Asia. This representation of the orography of Asia can now be seen reproduced on a great

* It is interesting to note that a trace of the same desire is met with in all descriptions of travels. The very length of the words "north-east," "south-east," and so on, contributes to this.

number of maps, but it is only in the beautiful series of maps of Stieler's Hand-Atlas that the system which Petermann had accepted for his map of Asia, and which has been retained at Gotha since —proving admirably well adapted to embody all subsequent surveys— that one finds it kept in its entirety. In the new editions of 'Asia' and 'Central Asia' of the Stieler's Atlas, as well as in the admirably clear map of the small 'Taschen Atlas' of Gotha, one sees at a glance how the orographic structure of Asia appears when it is conceived in this way.

The distinctive features of this system are the following: The great plateaux of Tibet, Central Asia, and Siberia belong to the same system of massive upheavals. There are two distinct terraces in these plateaux: one upper in the west, and one lower in the east, while several still higher terraces rise in the south, in Tibet. The mountain ranges are entirely subordinated to the plateaux, and run chiefly from the south-west to the north-east; but they are crossed also by a number of ranges running nearly perpendicular to the former, that is, towards the north-west (or rather west-north-west).

As to the Stanovoi, the chain of mountains which was traced west to east to the north of the Amur, it has disappeared. On the contrary, the Great Khingan, which formerly was traced running north and south, but which had never been visited by any geographer north of the 50th degree of latitude, where I have crossed it, runs south-west to north-east, and joins the chain of mountains, Jugjur or Stanovoi, which fringes the sea of Okhotsk. It will be seen further on why I gave it this direction.

This is well seen on all the maps published by the Gotha Institute.* As to other cartographers—without inquiring why the Stanovoi and the Khingan were traced in this or that direction on older maps (hypothetically, of course, as there were no regular surveys, and none have been made since), and why their directions have been changed in the Gotha editions—they combine in an arbitrary way the representation of Petermann with the old representations of mountains (the highest ranges along the main water-partings).†

* An exception must be made for the map of Eastern Siberia, just published by Habenicht. On this map we see again reappearing, under the name of Ilkhuri alin, a high range which runs west and east under the 51st degree of latitude in the west of the Amur. Herr Habenicht has evidently taken it from the Russian maps, upon which this range continues to be drawn, not on the basis of some new surveys, but merely as a reminiscence of the chain of mountains which was traced hypothetically around the head of the basin of the Nonni, on the map of China of the Jesuits (in Du Halde). It must be remarked, however, that *none of the Jesuits have been north of Merghen*, and that till now there have been no surveys in this region, as Herr Habenicht himself implies in giving the Kumara and the upper Nonni in a broken tracing.

† The survey of the western part of the Stanovoi, which was made in 1850, and which I saw at Irkutsk, has perished during the conflagration of this city, without

The work of Prof. Muschketoff in Turkestan permitted us to make a further step forward with the orography of Asia. The Russian geologist has proved that the mountain ranges of this part of Central Asia belong to two different systems: those which run south-west to north-east are the most ancient, and belong to the pre-Silurian, Silurian, and Devonian ages, while those which run north-west to south-east are of a more recent origin, and belong to the Secondary age. These two systems probably must be found in Eastern Siberia as well, and if I could now do afresh the work which I did a quarter of a century ago, I probably should, by looking for upheavals in this second direction, avoid certain difficulties which I found, especially in the basin of the Yenisei. As to the mountains of North Tibet—the Nan Shan, and on the borders of Southern Mongolia—they all confirm this view of the double direction of the main systems of upheaval.

I will also permit myself to ask the following question: Shall we not find, in the systems of mountains of Eurasia, traces of still more modern upheavals, which may be going on now, and whose axis should be directed from north to south? Thus the Urals are composed of several chains of mountains having the direction south-west to north-east, and of escarpments having a north-west to south-east direction (see my article "Urals" in the 'Encyclopædia Britannica,' 9th edit.); but there are also distinct traces of foldings of the Earth's crust which took place along lines directed from north to south, and I ask myself if we have not here a recent system of foldings which carries with it the formerly existing ranges of hills, and produces the accumulation of the greatest heights of a given region in a narrow zone directed north to south?

I will now sum up the ideas on the orography of Eastern Siberia which were brought forward in the above-mentioned publication, and I will consider afterwards how the system of orography of Eastern Siberia accords with the orography of Asia altogether, such as it now appears from the recent explorations in Central Asia.

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having been utilized (I utilized only part of it in my map of the Olekma-Vitim region). As to the eastern part of the Stanovoi, we have only one single itinerary, viz. that of Schwartz, who crossed this region in 1851 at the sources of the Konam; but this survey has never been published, and could only be produced from the diary of Schwartz—which, having been given to me by Schwartz in 1870, remained with all my papers at the archives of the State police in Russia, where they were found only in 1895, and delivered to the Russian Geographical Society, which sent them to me, to London. I hastened, of course, to return this precious document to the Geographical Society. However, even when this diary will be utilized, there will be all the region between the Konam and the Olekma (nearly 170 miles), and all the space between the Konam and the Okhotsk coast (nearly 300 miles) still remaining absolutely unknown.

II. The Orography of Eastern Siberia.*

General Conclusions.—(1) The main mass of the highlands of Asia is represented in Siberia by an immense high plateau which spreads from the south-west to the north-east, that is, from the basin of the Yenisei to the sea of Okhotsk, losing in width and altitude in proportion as it advances north-east.

(2) A second plateau, or rather a second terrace of the above, having the same orientation, but of a slightly smaller altitude, fringes the high plateau along the whole of its length from its south-eastern side.

(3) These two plateaux, taken as a whole, have along their north-western and south-eastern fringes two high border-ridges. The former (that is, the north-western one) is higher than the second. It is there that we find the highest summits of mountains in Eastern Siberia. Both border-ranges also become lower as they progress towards the north-east.

(4) On its north-western slope the high plateau is fringed by a zone of mountains from 130 to 220 miles wide, which has a well-defined Alpine character. It consists of high mountains and peaks, separated by deep valleys, and in the labyrinth of the ramifications of its separate mountain ranges one may distinguish a general orientation from the south-west to the north-east, parallel to the border-range of the plateau. The chains of mountains of this Alpine zone are composed of crystalline and clay slates (often auriferous), as also of granites, syenites, and so on. The height of the mountains in this girdle also decreases towards the north-east.

(5) Beyond the Alpine zone we find, on the same north-western or Arctic slope of the plateau, a wide stretch of high plains, 1500 to 2000 feet high, formed by layers, often horizontal, of more recent sedimentary deposits (Upper Devonian, Secondary, and Tertiary).

(6) The high plains are followed, on the same Arctic slope, by lowlands which rise only a few hundred feet above the level of the sea, and reach both the Arctic ocean and the footings of the Urals. In the southern parts of Western Siberia the lowlands are separated from the high plains by an escarpment; but it is not yet known whether such an escarpment can be traced along the whole line of separation. Isolated chains of mountains rise here and there over the surface of the high plains, as well as of the lowlands, the former also having in preference a direction either south-west to north-east, or from the north-west to the south-east.

(7) Passing over to the Pacific slope,—in those places where we know well the boundary between the high plateau and its lower terrace,

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* 'General Sketch of the Orography of Eastern Siberia,' in Memoirs of the Russian Geographical Society, General Geography, vol. v., 1875 (Russian).

these two are separated from each other by a border-range which follows the escarpment of the high plateau. However, we do not know yet whether this border-range can be traced beyond the 55th degree of latitude.

(8) On its south-eastern or Pacific slope, the plateau (*i.e.* its lower terrace) is also fringed by a border-range (Great Khingan) which falls with an almost abrupt escarpment towards the high plains of the Pacific slope. The latter are slightly lower than those of the Arctic slope, and on a very large stretch they also are fringed by lowlands. But both the high plains and the lowlands are missing where the sea of Okhotsk reaches with its waters the very foot of the south-eastern border-range of the plateau (from Uda bay to Okhotsk).

(9) Over a great portion of its length the south-eastern border-range of the plateau is also fringed by an Alpine zone, 70 to 160 miles wide, which separates the plateau from the high plains. Two parallel mountain ranges can be distinguished in this Alpine zone.

In the midst of the plains and the lowlands of the Pacific slope we also see several distinct chains of mountains, running north-east, as also a series of littoral chains, part of which are in Manchuria, while the others are partially submerged. As a rule, they are also oriented in the same direction as the south-eastern border-range of the plateau. This structure of Northern Asia is represented in the cross-section, Fig. 3.

A.—§ 1. *The High Plateau.*—Its main features are as follows: With the exception of the deep valleys excavated by a number of rivers flowing towards Lake Baikal, which we shall refer to as "trenches," the bottoms of the valleys, even of the great rivers which water it, are situated at considerable altitudes, of from 2800 to 3500 feet. It is only as the rivers reach the peripheral parts of the plateau that their beds are cut in it to a greater depth. As to the water-partings between the rivers, they have as a rule a very flat aspect, and are marshy in the northern parts of Siberia; they hardly rise 1000 feet above the bottoms of the valleys. The river-valleys are wide, open, and marshy in their upper courses, and the traveller who crosses the plateau finds no obstacles excepting in the marshes. Only occasionally a few chains of mountains, parallel to the general direction of the plateau, rise above its average surface by 1000 or 1500 feet. Countless lakes, large and small, cover its surface, our present maps giving only a very imperfect idea of their numbers. In most cases the rivers which water its surface flow parallel to each other. The vegetation which covers the plateau is extremely monotonous, chiefly consisting in the forests of the north of larch and birch. There are reasons to believe that the fauna of the high plateau has a certain distinctive character which, however, has not yet been completely studied.

FIG. 3.—SCHEMATIC SECTION ACROSS EASTERN SIBERIA, FROM NORTH-WEST TO SOUTH-EAST.

§ 2. We know this plateau over a very wide area; namely, in North-Western Mongolia, on the upper Yenisei, and in the neighbourhood of Lake Kosogol; to the south of Lake Baikal; on the route from Kiakhta to Urga; further on, in Transbaikalia, on the upper Uda (high-road to Chita), on the Chikoi and the Khilok; and then, over immense areas in the basin of the Vitim, the Olekma, and the Tunghir; on the water-parting between the Karenga and the Vitim on the one side, and the Holoï on the other side; at the sources of the Aldan; on the Konam; in the upper parts of the Zeya; and on the two routes from Yakutsk to Udskoi and to Okhotsk. In all these places the character of the high plateau is very typical.

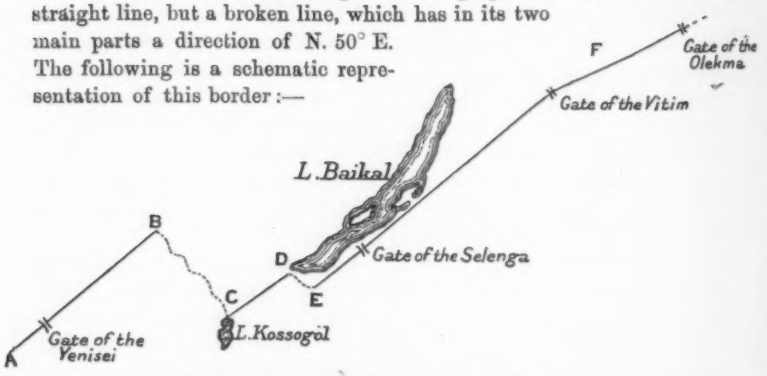
§ 3. The high plateau thus represents an uninterrupted swelling of the Earth's surface, from Mongolia to the far north-east of Asia. It has only been deeply eroded in the vicinity of Lake Baikal by its great affluent, the Selenga and its tributaries (Jida, Orkhon, Tola, Uda, and also the Khilok and the Chikoi). Here the broad and deep valley of the Selenga penetrates southwards, like a deep railway-trench, dug into the plateau, and leads with a small gradient from the lake (1400 feet of altitude) to Urga, situated on the level of the plateau, near its south-eastern border, at an altitude of 3800 feet. A similar trench leads eastwards, up another tributary of the Selenga —the Uda—from the Baikal to Chita, and it is now taken advantage of by the Trans-Siberian railway. Travellers who went along these valleys did not always realize that they were travelling along such trenches excavated in the plateau. As they saw steep, rocky escarpments on both sides of the valley, they only yielded to an irresistible optical illusion when they described these escarpments as chains of mountains. However, as soon as one abandons the valley and goes 10 or 20 miles inland, one finds one's self on the level of the plateau. These "trenches" have rendered an immense service to man. It was along them that the plateau could be climbed, and that the communications between the two slopes of the great plateau of Eastern Asia were established. Elsewhere, far from the great Siberian lake, where the valleys have not been transformed by erosion into such trenches, there is no other means to reach the level of the plateau but to travel up the wild and narrow gorges of the Vitim, the Olekma, or the Aldan, or to climb over the steep slope of its border-range.

It must also be remarked that not one single river cuts through the whole width of the plateau. All of them take their origin in the marshes and lakes scattered over its surface—sometimes near its south-eastern edge; but it is only in their lower courses, on approaching the north-western edge, that their valleys become deeply sunk in the massive upheaval. On approaching Lake Baikal, the bottoms of these valleys take the character of flat steppes and prairies, covered with gravel and dotted with small lakes. In all probability they were

formerly—probably during the Jurassic period—bays or fjords of a large inland sea, which covered also what are now the high plains of Eastern Siberia (Balagansk, Nizhne-Udinsk, Kansk, Minusinsk) and penetrated, in the shape of elongated fjords, in a succession of "longitudinal valleys" (§ 7), which now separate the plateau from the Alpine zone which fringes it.

B.—§ 4. *The North-Western Border-Range of the High Plateau.*—The High Plateau is fringed along its north-western border by a high border-range, which contains in it the highest summits of Eastern Siberia—Munku-sardyk, Khamar-daban, etc. The average altitude of its crest is higher, as a rule, than that of the crest of any other mountain range in Siberia, taking them in the same meridian; namely, from 6000 to 8000 feet in its western parts, and from 3000 to 4000 feet in the far north-east. Its width is from 17 to 25 miles. Its south-eastern foot lies on the surface of the plateau, *i.e.* at an altitude of from 4000 to 3000 feet in the west, and about 2500 feet in the east, while its north-western foot lies in the just-mentioned longitudinal valleys, at altitudes of from 1500 to 2000 feet in the west, and about 1000 feet or less in the east. This mountain range has thus the well-defined type of a border-range of the high plateau. The summits of its peaks have, as a rule, very soft outlines, and the passes through it, instead of following narrow gorges, as is the case in Alpine chains of mountains, in preference go over the very flat summits of the mountains. A typical feature of this border-range is also that we find on both its slopes a great development of volcanic eruptions in the shape of flows of lava, filling certain valleys or spreading over extremely wide superficies on the surface of the plateau.

§ 5. The north-western fringe of the high plateau does not follow a straight line, but a broken line, which has in its two main parts a direction of N. 50° E. The following is a schematic representation of this border:—



Schematic representation of the Northwestern Border Range of the High Plateau

FIG. 4.

We know this border-range in many places, beginning with the Us, in the basin of the Yenisei (where it was described by Schwartz), then following the Sayan (Polyakoff, and partly Radde), the mountains on the left bank of the Barguzin (Georgi, Lopatin), the South Muya Range (our Vitim Expedition), and on the right bank of the Chara (Usoltseff). We thus know this chain without interruption from the Yenisei to the sources of the Uda, for a distance of about 350 miles (AB in Fig. 4); from Lake Kosogol to Lake Baikal, over 170 miles (CD of Fig. 4); and from Barguzin to the sources of the Chara, nearly 500 miles (EF).

There is some difficulty in explaining the absence of a border-range between the first two just-mentioned portions, but if we imagine Eastern Siberia submerged under a sea 2000 feet higher than at the present time, the continent would be represented by the Sayan and Vitim plateau. In the portions marked in full black lines in Fig. 4, we should have had an uninterrupted shore-line, fringed by a high chain of mountains, similar to the Andes in South America, while in the parts BC and DE there would have been a number of narrow bays penetrating into the depth of the continent. This was, at least, the explanation which I gave in 1875. However, the numerous expeditions which have been made to North-Western Mongolia during the last twenty-five years seem to leave no doubt about the existence of a border-range running in a *north-western* direction in part of the space BC of the above drawing. We should have thus in North-Western Mongolia what we have in Northern Tibet on a larger scale, namely, a succession of higher terraces of the plateau fringed by mountain-ranges running south-west to north-east and north-west to south-east (or rather west-north-west to east-south-east).

The relations are also difficult to ascertain in the neighbourhoods of Lake Baikal (DE of Fig. 4). It would seem as if the lake had penetrated by its southern extremity into the depth of the high plateau, and that at this spot we have the greatest absolute depression by the side of the greatest elevations of the border-range—the bottom of Baikal being in places as low as from 3600 to 4740 feet below the sea-level, and the tops of the mountains along the southern shore of the lake reaching from 8000 to 10,000 feet. It is worthy of note that the presence of deep depressions — in this case much below the level of the ocean—appears in three distinct spots which are all situated along the north-western fringe of the high plateau (Fig. 5), in the Caspian sea, at Lukchun, and in Lake Baikal.

As to the interruptions in the border-range which we see in the valley of the Selenga, they offer no difficulty if we consider this valley—as has been suggested in the previous paragraph, and as it is in reality —as a deep trench, through which the waters that accumulated on the surface of the plateau found, from a very remote geological period,

a passage to the lower level of Lake Baikal. From the Selenga eastwards as far as the headwaters of the Chara (119° 20′ E. long.), there is no interruption in this tremendous border-range for a distance of more than 500 miles, and everywhere it retains the very same orographic character as appears from the descriptions of Georgi, Lopatin, Schwartz, Orloff, myself, and Usoltseff (from the Barguzin to the Chara).

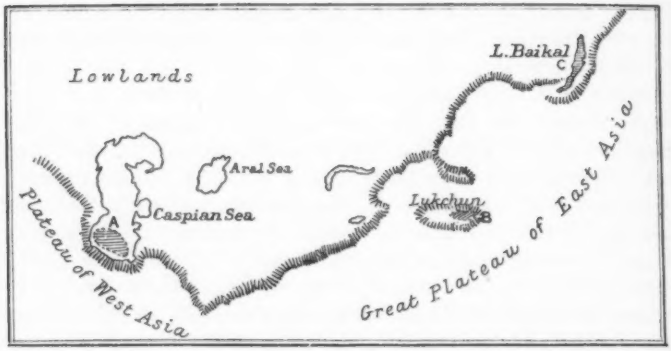


FIG. 5.—DEPRESSIONS, BELOW THE SEA-LEVEL, ALONG THE NORTHERN BORDER OF THE PLATEAU.

As to its further continuation towards the east, we find valuable information in the already mentioned manuscript diary of Ludwig Schwartz, where we have a beautiful description of a quite typical plateau in the valley of the Upper Zeya, and especially along the Konam river. "Wide, elevated, and marshy plains, with rivers slowly flowing over their surface; broad, flat valleys covered with countless small lakes, and having their bottoms at altitudes of 2500 feet." Such is the description which Schwartz gave of this region in his diary, so that I am almost inclined to give to this immense plateau the name of Sayan-Vitim-and-Konam Plateau. It is only on the right bank of the Aldan (a great tributary of the Lena) that Schwartz found a chain of mountains similar in its character to the South Muya border-range which we met in the basin of the Vitim.

We have thus one range of mountains which may be followed almost without interruption from the Yenisei to the sea of Okhotsk, the only really typical mountain-range in Eastern Siberia, to which I propose to give the name of *North-Western Border Range of the High Plateau of East Asia.*

In Western Asia, the Altai and the Tian-shan play the same part of border-ranges, and "It is very probable"—I wrote in 1876—"that these two mountain ranges may represent one, from an orographic and an orogenetic point of view." This suggestion, as will be seen

presently, has been fully confirmed since, by subsequent exploration. It must be remarked, of course, that the altitude of both the plateau and its border-range diminishes in proportion as we advance towards the north-eastern extremity of Asia.

§ 6. There are besides on the surface of the plateau a number of ranges of mountains which, in the classification of Karl Ritter, ought to be described as "superposed chains of mountains" (*angehäufte Gebirge*). They represent elevations of a moderate relative altitude, rising not more than from 1000 or 1800 feet above the average surface of the plateau. Most of them (nearly all in East Siberia) are parallel to the border-ridges. They are marked on my maps by a special sign. None of these ranges of hills can interrupt the uniformity of the plateau, and such chains deserve our attention only because they determine the parallelism of the high valleys. It must be remarked that the same structure which I noticed on the Vitim plateau was found later on in the plateaux of Central Asia and Tibet, where we also find numerous chains of mountains rising some 2000 to 3000 feet above the 12,000-feet level of the plateau, and in North-Western Mongolia.

C.—§ 7. *The Alpine Zone of the North-Western Slope.*—At the foot of the north-western border of the high plateau we find in many places a broad and very typical longitudinal valley which runs parallel to the crest of the border-range. By using the term "longitudinal valley," I do not mean, however, that this valley owes its origin to a longitudinal fold of geological strata. That its origin was primarily determined by some such foldings of the Earth's crust is very probable, but as we see it nowadays it is the result of erosion, both by rivers and by ice-streams, which was going on for ages on a gigantic scale. Perhaps it would have been more correct to describe this feature as a succession of longitudinal valleys, interrupted here and there by transverse upheavals. To take a familiar example, the valley occupied by the Rion and the Kura rivers in the Caucasus—the one flowing towards the Black sea, and the other into the Caspian, and the two being separated by the Mesques mountains—belongs to the same type, and it is also situated at the foot of a high plateau—the plateau of Armenia and Asia Minor, between this plateau and the alpine region of the Caucasus, which fringes it.

In Eastern Siberia, this succession of longitudinal valleys is very striking. The valley is usually limited on the south-east by the escarpment of the border-range of the high plateau, while on its north-western side we see rising, abruptly as a wall, the sharply carved slopes of an extremely regular rocky chain of mountains. The width of this valley is usually from 10 to 25 miles. Its base is flat, and assumes in its lower parts the character of prairies covered with lake and river deposits, having altitudes of from 1500 to 2000 feet in the west, and about 1000 feet in the north-east. It is a very common

feature for two rivers to flow in diametrically opposite directions in this valley, either to meet each other (Muya and Chara) or to run in opposite directions, after having taken origin in a transversal upheaval, like the Rion and the Kura in the Caucasus (Oka and Irkut; Barguzin and Muya). We know such valleys: in the basin of the Yenisei, the valley of the Us; in upper Oka and the Irkut; the Barguzin; the Muya; the Chara; and the Aldan.

§ 8. In all these regions, which represent an extension of nearly 40° of longitude, we find a typical "rocky chain of mountains" bordering these longitudinal valleys from the northern side. The Tunka Alps, the Barguzin Alps, the North Muya Mountains, and their continuation—the rocky chain which runs on the right bank of the Chulban and the left bank of the Chara, belong to the same type of mountains facing the longitudinal valleys; and the likeness between the drawings of Erman and myself of homological chains of mountains on the Irkut, the Aldan, and the Muya, is striking.

The Irkut, in the part where it flows between the rocky Tunka Alps and the Sayan border-range, represents a typical longitudinal valley of this sort; and we find one of exactly the same type to the east of Lake Baikal, in the valley of the Barguzin. As to the space between the two, various conjectures may be made. The Irkut, as has just been mentioned, is accompanied on its northern bank by an extremely typical, rocky chain of mountains, which is known as the Tunka Alps, or The Goltsy (naked peaks), or the White Mountains (Byelki; they are snow-clad); and on the east coast of Lake Baikal we find in the valley of the Barguzin a chain of mountains having absolutely the same typical aspect, and placed in identical relations with regard to the plateau. Further east, we see the same valley and the same rocky chain continued as far as the Aldan—a length of 400 miles. We notice, moreover, that the Barguzin mountains fall exactly on the continuation of the axis of the Tunka Alps, and that where this chain is interrupted by Lake Baikal, there are the only two insular masses of this lake, the island of Olkhon and the peninsula of Svyatoi Nos, in both of which the sedimentary rocks run from the south-west to north-east (Meglitzky and, later on, Chersky). As to the interruption between the Tunka Alps and the island of Olkhon, we have to deal with a region very imperfectly known as to its geological structure. Taking all this into consideration, I permitted myself to suggest that the Barguzin mountains are a continuation of the Alps of Tunka. This last chain of mountains, parallel to the border-range of the high plateau, begins, I should believe, near the sources of the Oka. It continues between the Irkut and the Kitoi under the name of Tunka Alps; then it is cut through by the transverse valley of the Angara, but it reappears further east between the stream of Kuda and its tributary, the Kamenka, on the one side, and the shore

of Lake Baikal on the other side. Next it is cut through by the strait of Lake Baikal, which connects the "great sea" with the "small sea" (*i.e.* the southern and the northern portions of the lake); and further on we find the same chain under the name of Barguzin mountains, while further on still I have named it North Muya mountains, and further still we might name it North Chara mountains, until we lose its traces in regions yet unexplored.

If this hypothesis be true, it would thus appear, I wrote, that Lake Baikal does not represent a longitudinal valley. It is, on the contrary, composed of two longitudinal valleys—the Irkut-Barguzin one, which makes the "great sea"; and a second valley which forms the "smaller sea"—both being connected by the strait between Olkhon island and the Svyatoi Nos peninsula. As to the chain of mountains, Baikalskiy Khrebet, which is represented on our maps in an uninterrupted succession along the western shore of the lake, from the Angara to the lake's northern extremity, I was very much inclined to believe that a more detailed exploration would prove that there are in this region two or even three different chains of mountains—two or three different foldings of the strata—which cross the present Lake Baikal in a diagonal direction.

Such were my conclusions in 1875, when we possessed only the researches of Meglitzky and a preliminary report from Czekanowski. Since that time we have had the works of Chersky and Obrutcheff, of which the former confirms in full detail what Meglitzky had discovered, namely, that the sediments of the western coast of Lake Baikal are continued on its eastern coast; the direction being from south-west to north-east, as is seen on the enclosed reduction of the map of Chersky, upon which I also have given the results of the recent soundings in the lake (Fig. 6). One sees, moreover, that instead of the range of mountains, Baikalskiy Khrebet, which is drawn on the maps, there are at least two parallel chains which reach the coast of the lake at sharp angles and are continued on the other coast. The Baikalskiy Khrebet would thus be only a succession of steep escarpments falling towards the lake. At any rate, we have here a problem which requires further detailed exploration.

As might be expected, the just-mentioned rocky mountain range is pierced in more places than the border-range itself; by the Yenisei, the Irkut (below Ilcha), and the Angara; lake Baikal, the Vitim at the mouth of the Muya, and the Olekma under 58° N. lat. This is also what might have been expected.

The accumulations of water on the surface of the plateau had, of course, to find a way to the ocean, and those of them which took a north-western direction formed a succession of large lakes, all along the north-western foot of the border-range; we still see traces of such lakes in the Kosogol, Shaksha, Bahunt. However, this state of affairs

Geological Map of the Shores of Lake Baikal, after Chersky.
Depths after Drizhenko.

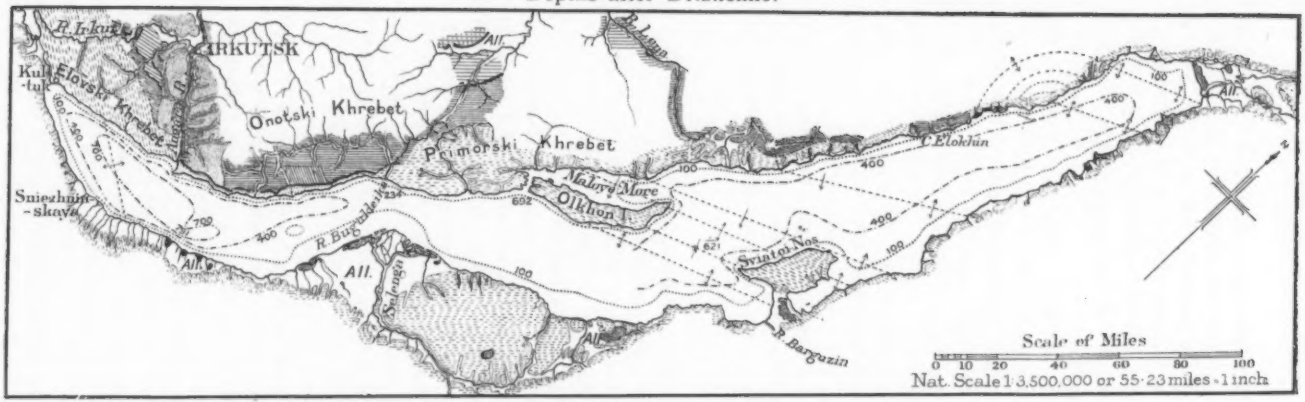


FIG. 6.

could not last infinitely; the waters had to find a passage from the continent towards the ocean; and they opened such passages in the gates of the Yenisei and the Selenga, the Vitim, and the Olekma. Then they formed very large elongated lakes in the above-mentioned "longitudinal valleys," thus forming a girdle of lakes which ran south-west to north-east, at the foot of the border-range. However, here also the accumulation of water could not last for ever. The lake which once filled the valley of the Us found its way towards the lower-situated plains of Minusinsk. The Baikal began to send part of its waters into the lakes of the Balagansk region; the "great sea" of the Baikal found a passage into the "little sea," by three different gates; the lakes of the Muya found an outlet into the basin of the Oron; and so on. All this was evidently accomplished by slow geological evolution, and where the basin was the largest (the Selenga), the gates that were cut northwards were also the most numerous; thus we find no less than three gates in the rocky chain of mountains facing the gates of the Selenga.

§ 9. Beyond the rocky chain of mountains we have a wide zone of highlands bearing an alpine character. This zone is composed of a number of short chains of mountains which are mostly parallel to the border-range, *i.e.* mostly run in a direction of N. 50° E. The chains are separated from each other and intersected by a labyrinth of narrow and deep valleys. This zone of highlands, in opposition to the plateau, has all the characteristics of alpine regions, presenting variety and differentiation in all directions. High summits rapidly alternate with deep valleys, the former reaching altitudes of from 4000 to 7000 feet, while the bottoms of the valleys are at all levels, beginning with 3000 feet down to 1000 feet, and consequently all the physical characters of the region and its vegetation change with the same rapidity. The wild character of these mountains and the virgin forests which cover them have resulted in the generic name of "*Taiga*" being given to the whole of the region. In nearly all this alpine zone one finds traces, quite evident in my opinion, of previous glaciation on a very large scale. The chains of mountains send—as usual in such highlands—numerous ramifications, and result in a labyrinth of small valleys, but there are in places local plateaux of a secondary order.

Geologically, these highlands are chiefly built up of crystalline slates, upheaved and contorted by veins of granite, syenites, and diorites; clay-slates and quartzites have a very wide extension, but the characteristic feature is the extension of hard clay-slates and chloritic slates (often auriferous). It may be said that in all probability they belong to the Huronian, Cambrian, Silurian, and perhaps the Devonian ages, and the foldings are of a less ancient origin than the plateau itself.

Such systems of mountains appear all along the fringe of the plateau, and are described under different names. In the highlands

of Southern and Middle Yeniseisk, we can distinguish three separate chains of mountains running south-west to north-east, probably intersected by both spurs of the Altai system and by upheavals having a north-western direction. A broad gulf of an ancient sea penetrates into these highlands in a south-eastern direction, forming now the high plains of Nizhne-Udinsk. Next come the highlands of the Biryusa; those of the Oka, in which I crossed three chains of mountains running from the south-west to the north-east; the Alps of the Kitoi; and the Baikal mountains;—all of which still remain but imperfectly known, and thus represent a most promising field for the physical geographer. To the east of Lake Baikal we have the mountains of the Upper Angara and the Mama, almost quite unknown, and about which I advanced a few considerations in my 'Vitim Expedition Report';* the highlands of the Olekma-and-Vitim, which are composed of parallel chains having the same north-eastern direction, with numerous ramifications and subordinate plateaux; and finally the almost quite unknown highlands of the Chara.

Going further east we miss information about the alpine highlands. The plateau appears with its typical features to the south of the Konam river (Schwartz), on the Aim and the Uchur (Middendorff, whose drawings representing the aspect of the country before reaching the watershed of the Stanovoi express very well the character of the plateau), and finally on the highway from Yakutsk to Okhotsk (Ermann). The character of this last region is represented in the corresponding cross-section which I give here. However, the highlands which fringe the plateau on the north-west do not seem to have in the far north the same typical character as they acquire in lower latitudes. It may possibly be that they become lower, like the plateau itself, or maybe they are obliterated by old bays of the Glacial ocean. It must only be remarked that in the extreme north, on the coast of the Glacial ocean, we find, on the prolongation of the East Siberian plateau, highlands which attain as much as 2000 feet of altitude.

D.—§ 10. *The High Plains.*—At the foot of the alpine regions, which have been described in the previous paragraph, we find immense high plains, whose altitude varies from 1500 to 2000 feet in the west, to 800 and 1300 feet in the far north-east. If we take a map of Eastern Siberia on a marine projection, and draw upon it a line, from the sources of the two Yuses (54° N. lat., 99° E. long.) to the mouth of the

* I hazarded in that report the supposition that the auriferous chain in which are located the chief gold-mines of the district of Olekminsk—Obrutcheff has since given it my name—must have a direction from the north-east to the south-west, and from the specimens of rocks which Schwartz had brought in from the Vitim, I determined the place where the Vitim must pierce this chain, as also its probable further continuation in the basin of the Mama. I learn now that rich placers have been discovered since on the Mama; but that is all I know about this interesting region.

Indighirka (72° N. lat., 150° E. long.), we shall have the approximate boundary which separates the alpine highlands of East Asia from the high plains. This line would, of course, be only an ideal limit, because in certain places, and especially between Tomsk and Kirensk, the high plains penetrate into the highlands in the shape of a large gulf directed towards the south-east. We may also determine this boundary-line with more precision, if we say that it runs parallel to the border-range of the high plateau at a distance of about 200 miles to the north-west of it. This boundary-line would consequently have the same broken character as the escarpment of the plateau itself (line DF in Fig. 4).

The high plains are characterized by the total absence of mountains and by an undulating surface which is mostly covered by forests in the north, or assumes a steppe character in the south. The rivers which water them flow in valleys that are sunk for 400 to 800 feet into the mass of the plains. They are entirely built up of marine deposits, the oldest of which belong to the Silurian period, and most of which, beginning with the old red sandstones of the valley of the Lena, are nearly almost horizontal. The region which is crossed by the great Siberian highway (now the railway) between Achinsk and Nizhne-Udinsk, and has altitudes of from 1200 to 2000 feet; the immense spaces between the Yenisei and the lower course of the Lower Angara; between the Angara and the Lena; and this last and the Vitim; the region watered by the Vilui;—all belong to the high plains of this type. Only small local upheavals introduce a certain variety into the structure of these plains; but those parts which were described as hilly owe this aspect of their structure to the deep erosion of the rivers. An exception is only found in the mountain region named Northern Yeniseisk-taiga, where we find an alpine highland, composed of several chains of mountains running in a north-eastern direction; and further north, in the Verkhoyansk range.

E.—§ 11. *The North-Western Lowlands.*—In the north-west of these high plains we find the lowlands of North-Western Siberia, which cover a still wider area; their average altitude is usually less than 500 feet. We cannot say if the high plains are separated from the lowlands by an escarpment, such as we see in the plains of Western Siberia, near Tomsk, but we find in one place that the Northern Yeniseisk highlands rise on the boundary between the high plains and the lowlands. These lowlands, as is known, were under the sea during the post-glacial period, and are covered with post-glacial deposits. Tertiary deposits have also been found in several places.

§ 12. The Pacific Slope of the Plateau. *F. The South-Eastern Escarpment of the Plateau.*—The high plateau is fringed on the south-east, as if by a broad ribbon, along nearly the whole of its length, by another plateau of smaller altitude, which has a slightly different character (see §§ 16, 17), and is especially typically developed in the

Nerchinsk district of Transbaikalia and the Eastern Gobi. In the far north-east the high plateau seems, however, to melt into its lower terrace without being separated from it by a notable escarpment.

§ 13. As a rule, the two terraces of the plateau are sharply separated from each other, the upper falling towards the lower by a steep escarpment, nearly 1000 feet high. The latter is very typically developed, for instance, on the railway from Irkutsk to Chita, in the Stanovoi or Yablonovoi Khrebet. On part of its stretch, but by no means along its whole length, this escarpment represents the line of water-parting between the rivers which flow towards the Glacial ocean and those which flow into the Pacific. The former rise in marshes and lakes which are spread along the fringe of the escarpment, while the streams which flow towards the Pacific take their origin on the rocky and steep slope which falls towards the lower terrace. In other places the headwaters of the rivers flowing towards the two oceans lie in the same marshes, spreading over the surface of the plateau.

The south-eastern escarpment cannot be described as a typical border-range, although in places it has that aspect. Over a very considerable length it is merely an escarpment, which appears as a chain of mountains to the traveller only who looks upon it from the lower terrace, while the traveller who approaches it from the plateau learns that he is crossing the water-parting between the two oceans only when he begins to go down the steep slope that leads to the lower terrace. When the escarpment takes the character of a border-range, its summits do not rise more than from 500 to 800 feet above the average level of the plateau, and not more than 1500 feet above the bottoms of the nearest valleys lying at its foot on the plateau. It attains a considerable altitude only for a short distance, namely, about the Sokhondo (8000 feet).

§ 14. We know that escarpment (*a*) on the route from Kiakhta to Pekin, which reaches the highest point of the plateau immediately in the south of Urga, and then descends steeply towards the lower terrace; (*b*) to the north-east of Urga, where it is known under the name of Kentei (survey of Dorjidaroff); (*c*) at the sources of the Chikoi and the Balja, which both belong to the system of the Pacific (altitudes determined by Fuss); (*d*) on the road from Irkutsk to Chita, which passes the lakes Shaksha, etc., 3000 feet of altitude, and then suddenly goes down for 1200 or 1350 feet to the valley of the Chita; (*e*) on the route which our expedition followed on approaching Chita.

It is worthy of note that in the last two places the escarpment is faced—in homology with what we saw on the north-western slope of the plateau—by a rocky chain of mountains, which separates it from the plains of the lower plateau.

§ 15. In all the above-named spots the south-eastern escarpment

of the high plateau corresponds with the Stanovoi range of the old geographers. In other words, this escarpment is in reality the water-parting between the basins of the Arctic and Pacific oceans. It is extremely difficult, however, to follow it further east. I have made some attempts to do so in my "Orography of Eastern Siberia," and I now learn from the classical work of Suess ('Das Antlitz der Erde,' vol. iii.) that my conjectures were correct (see below); but it must be confessed that we still remain in the dark, and that careful surveys, specially intended for mapping this escarpment, ought to be made before any definite conclusion can be come to as to the existence of a sharp division between the upper and the lower plateau in the north of the 52nd degree of latitude. It is very possible that to the east of the 190th degree of longitude the difference of altitude between the two plateaux is considerably reduced. At any rate, we find in the already-mentioned diary of Schwartz no distinct indication concerning the existence of two distinct terraces of the plateau, either on the Aldan or on the Zeya, nor do we find such differences in the itineraries of Middendorff and Ermann, who crossed the plateau further east.

Another supposition could also be advanced. We might suppose that after having followed for a time a north-eastern direction, the escarpment turns eastwards and joins, near the coast of the Sea of Okhotsk, the Jugjur, or Stanovoi. In this case all the rivers which take their origin south of this supposed escarpment would flow towards the Pacific, while those which rise in the north of it would flow to the Arctic ocean. In such case, the Stanovoi mountains, which used to be represented on all maps, would not be a mountain range, but would nevertheless represent an escarpment, perhaps due to erosion, by which the upper plateau falls towards the lower. The numerous sinuosities which this water-parting would represent would be explained by the erosion which was going on at the heads of the rivers flowing towards the Pacific. However, the examination of the materials collected by the Siberian expedition renders this supposition quite improbable. Thus we see, that starting from the valley of the Amazarkan, an affluent of the Amazar, a left-bank tributary of the upper Amur, and travelling up to its source, Usoltseff wrote, that he did not find any traces of the chain of mountains called Stanovoi, which is represented on the maps. The same was noticed by Schwartz, who travelled half a degree further east, namely under the 120th degree of longitude. Going up the Mogocha—a tributary of the Amazar, consequently belonging to the basin of the Amur—Schwartz reached the water-parting between the Amur and the Arctic ocean by following a quite flat region, which presented no traces of mountains. We thus find no traces of the escarpment, when we come to the sources of the Amazar, and still less of the parallel chain of mountains which follows it, as we saw, near Chita; nor do we find any traces of it further

east, on the Zeya, the Konam, and the Ghinim. In short, from a careful and detailed examination of all the available facts, we cannot but come to the conclusion that the Yablonovoi escarpment must continue in a north-eastern direction in the basin of the Olekma, where, in all probability, it must gradually disappear.

This is also the conclusion to which Suess, aided by Obrucheff, comes in his work, after having consulted some recent surveys.

§ 16. We may, therefore, sum up as follows. Over a distance (south-west to north-east) of more than 900 miles (from the 106th to the 120th degree of longitude), a steep escarpment, which gradually decreases in height, separates the upper plateau from the lower plateau. The peak of Sokhondo rises from it, and the escarpment runs in a straight line from south-west to north-east, from Urga (the Kentei) to the Kalakan river. Whether it is continued further, remains unknown. For a distance of nearly 600 miles this escarpment represents the water-parting between the basins of the Arctic and the Pacific; this feature, however, was unfortunately generalized, and has led to the creation, on the maps, of a chain of mountains called the Stanovoi, which was continued far beyond Transbaikalia, from Urga to Kamchatka. Such a chain does *not* exist in reality, and in order to give it a more regular aspect, the geographers (as had been already remarked by Schwartz in 1858) used to place the sources of the Nercha a full degree further south than their actual position. In reality, there is no such chain, whether high or low, whether steep or undulating, that would follow the line of division between the basins of the Pacific and the Arctic oceans. Schwartz had already perfectly well recognized it as regards the region of the Oldoi and the tributaries of the Upper Amur.

G.—§ 17. *The Lower Plateau.*—The lower plateau, which fringes for a great part of its length the upper plateau, also offers an undulating, usually flat surface, without great differences of altitude. The valleys of the rivers which flow over its surface are broad, open, and take the character of prairies or of dry steppes. Numberless lakes are scattered over its surface. Its average altitude is, as a rule, from 2000 to 2500 feet, but, of course, the larger rivers have their valleys sunk to a lower level, and in such cases the bottom of the valley has not more than 1200 or 1500 feet of altitude. From the upper plateau the lower differs mostly by the character of a steppe, or "rolling prairie." Deserts covered with salt appear only in its south-western parts. In its middle portions it assumes the character of prairie, while in the far north it becomes marshy, like the high plateau. Several parallel ranges of hills rise above its surface; they might be described as "superposed ranges."

§ 18. We know this plateau to the south-east of Urga, between the Kentei and the Great Khingan, under the name of Gobi, a dry rolling

prairie covered with gravel and intersected by ranges of hills having a north-eastern direction. Its altitudes vary between 2400 and 3000 feet. We find the same lower plateau in Transbaikalia, east of Chita, in the neighbourhood of the Dalai-Nor, and in the fertile prairies of the district of Nerchinsk. Further east we find the same type of elevated prairies (2000 to 2500 feet) on the left bank of the Upper Amur, in the marshy prairies of the Ghilui (Schwartz), and on the routes leading from Yakutsk both to Udskoi Ostrog, and Okhotsk (see the cross-sections). As already mentioned, it is not easy to separate the lower plateau from the higher one beyond the 124th degree of longitude.

§ 19. A number of parallel chains of hills run over the surface of this plateau; such are the mountains running on the right bank of the Ingoda, parallel to the above-mentioned escarpment, and reaching nearly 4600 feet in their highest points; a small chain which is crossed by the Ingoda above its junction with the Onon; the Gazimur mountains, which are made by folds of the Devonian deposits, between the Shilka and the Ingoda; the Nerchinsk mountains; and so on; as also a number of parallel rows of hills which stretch over the Gobi.

H.—§ 20. *The South-Eastern Escarpment of the Lower Plateau.*—The south-eastern escarpment of the lower plateau, and consequently of the whole of the plateau of East Asia, is formed by a border-range, which is known in its southern parts under the name of Great Khingan, and further north-east under the name of the Jugjur, or Stanovoi. This border-range rises very little above the average level of the plateau, but as we have here an escarpment which falls from the 2500 feet average level of the plateau to the plains of the Pacific slope, about 1000 feet high, it has acquired a great notoriety, especially among the Chinese geographers who themselves inhabited the lowlands of China. This border-range is a very typical one. Its north-western slope lies on the plateau itself, that is, at an altitude of from 2300 to 2700 feet; while its south-eastern foot lies in regions having hardly more than 800 to 1000 feet of altitude. The absolute altitude of its crest seldom exceeds 4500 feet, or maybe 5000 feet in the south-west. As we advance further north, it seldom exceeds 4000 feet. The traveller who comes from the side of the plateau reaches the crest of that border-range without noticing it. Such was the case with myself when I crossed the Great Khingan between Tsurukhaitu and Merghen, and the same remark was made by all the travellers who have crossed the Khingan since. Precisely owing to its position between the plateaux and the lowlands, this border-range has a very great importance as a limit for the westward extension of the Manchurian and Chinese flora and fauna, and it represents also an important climatic and ethnographic border.

§ 21. At the present time this border-ridge is perfectly well known from Kalgan (situated on the way from Kiakhta to Pekin) to the 50th

degree of latitude, where I crossed it. Over all this length it appears as the border-range of the Gobi plateau, and has absolutely the same character. Uncertainty begins only when we try to trace its further continuation beyond the 50th parallel. On most maps the Great Khingan was usually traced beyond that latitude in a meridional direction, as if it were crossed by the Amur just immediately below Ust-Stryelka. It must be said, however, that there are absolutely no surveys upon which such a tracing of the Khingan could be based—nobody having yet (1903) crossed the Khingan north of the 50th degree—and that the escarpment of the plateau surely has not that position. In the absence of definite surveys for this region, we are bound, consequently, in order to find the position of the Khingan, to see where an escarpment, similar to the one we know in the south of the 50th degree of latitude, will be found in the region of the left-hand affluents of the Amur. When we know where the plateau ends, and where the much lower terrace of the plains begins in the basin of the Zeya, we shall have found the position of the escarpment.

We have just seen that in the west of the Great Khingan we have a typical plateau, the altitude of which is from 2000 to 2500 feet, while the plains in the east of the Khingan, after one has crossed a narrow zone of mountains parallel to the escarpment, have already an altitude of no more than from 800 to 1500 feet. Higher altitudes will only be found in separate mountain ranges, such as the Bureya mountains and the Sikhota-alin. Leaving aside all conclusions from the position of the mountains on the Argun, let us consequently consider the altitudes in the basin of the left-bank tributaries of the Amur.

Eight miles below Ust-Stryelka, that is at the mouth of the Mongalei river, we do not find the Great Khingan. Usoltseff crossed this locality, marching towards the right Oldoi, without finding any mountains; he only saw flat marshes, and a hilly region was met with only at the sources of the Oldoi. It must be remarked that Usoltseff travelled here in a north-eastern direction, at a distance of no more than 25 miles from the Amur; that he crossed flat, marshy tracts having an altitude of only 2000 feet, and that we consequently find here no escarpment and no continuation of the Great Khingan. We must, therefore, conclude that the Amur between the Ust-Stryelka and the Oldoi does not pierce the Great Khingan.

However, Friedrich Schmidt, after having remarked how difficult it is to find the spot where the Amur pierces the Great Khingan, remarks that when he climbed, at the mouth of the Urichi river, one of the surrounding hills (Maslyanaya), he saw a succession of parallel ranges of mountains running north to south at a certain distance from the river Urichi. Schmidt considers that the Amur pierces here the Great Khingan. It seems to me, however, that there must be some

misunderstanding; either Schmidt saw the mountain ranges which are pierced by the Shilka above Ust-Stryelka—and in this case they are not the Khingan, but continuations of the Gazimur ranges—or he saw something which has the aspect of a hilly tract, but is not mountain ranges, because—as we have just seen—there are none between the Mongalei and the Uritchi. In all probability he saw the continuations of the Gazimur mountains. In fact, the level of the Amur between Ust-Stryelka and Urichi lies below 1000 feet, while the surrounding country on its left bank reaches the altitudes of 2000 to 2400 feet, or, perhaps, even a little more. It is evident that in such conditions erosion must have given a hilly aspect to the banks of the Amur for a certain, but small, distance from the banks, and that the eroded plateau may have here the aspect of a hilly tract. It is certain, however, that as a line traced from the mouth of the Mongalei to the Modolan does not cross the Khingan, and as the Oldoi lies on the general level of the plateau, the Amur cannot pierce the Khingan between the Ust-Stryelka and the Oldoi. This piercing must be looked for further east.

Owing to the difficulty in going down the Amur to say where this river leaves the plateau, I have tried to discover whether we shall not find the limits of the plateau in the basin of the Zeya. For this region we have the detailed diaries of Schwartz and Usoltseff. From an analysis of these two diaries, which I have made in the Russian text of my work, it appears that the plateau which was seen by Usoltseff and Orloff on the Oldoi is continued further east, without interruption, to the sources of the Ghilui, but that just below the junction of this river with the Zeya we find a sudden fall of the country from the level of the marshy plateaux (about 2000 feet) to the level of the plains, which have an average altitude of 800 feet only. We have thus an important landmark which shows us the position of the escarpment of the plateau on the Zeya, and if we connect this spot by a—roughly speaking—straight line with the Great Khingan under the 50th degree of latitude, we find the correct position of the escarpment. I came, therefore, to the conclusion that the Great Khingan is pierced by the Amur near the mouth of the Kumara, and that from this point the Khingan is continued in a north-eastern direction to the mountain range which runs along the western coast of the Sea of Okhotsk under the name of Jugjur. This conclusion is confirmed, moreover, by the geological structure of the mountains on the banks of the Amur (Maack), which I analyze in detail in the Russian text (see also its French translation), as well as by the sudden change in the character of the vegetation, which begins to be remarked on the Amur below Albazin.

§ 22. Two or three chains of mountains, reaching from 3500 to 4000 feet of altitude in their highest summits, and composed of crystalline slates and limestones, run parallel to the south-eastern escarpment of

the plateau, making an alpine zone of from 65 to 80 miles wide. I found such a zone of mountains on my journey to Merghen, and the same was found by all travellers who have crossed the Great Khingan, either near Kalgan or on the way to Tsitsihar. We find also such secondary chains on the Amur above Anosova; and on the Zeya above its junction with the Deup. Traces of homological chains are found further east as well.

§ 23. Taking all the aforesaid into consideration, we may say that the lower plateau falls towards the south-east—that is, to the plains and to the lowlands of the Pacific slope—by a steep escarpment, which has, broadly speaking, a direction from the south-west to the north-east; over most of its length this escarpment takes the character of a border-range, which is accompanied on its eastern side by a couple of parallel chains of mountains. The position of this escarpment, so far as may be ascertained at the present time, is as follows: From Kalgan, through the heads of the right-bank tributaries of the Nonni and the headwaters of the Kumara to the Amur, which pierces it under the 125th degree of east longitude; then, across the Zeya, near its junction with the Ghilui; between the left-bank tributaries of the Zeya and the right-bank tributaries of the Selinja; through the sources of the Ud, the Udyugun, and Nimni; and further on, under the name of Stanovoi, it passes through the headwaters of the Uyan, the left-bank tributaries of the Maya (system of the Lena), and finally the headwaters of the Okhota. Whether it can be traced further towards the north-east, we do not know. The distinctive feature of this escarpment is, that it is not a high mountain range, but a—so to speak—one-sided range, that is, the escarpment of a plateau which has on its fringe a border-range of but a moderate elevation; consequently, this line will in certain places make sinuosities in accordance with erosion at the sources of the rivers flowing towards the Pacific, or the slope may be lengthened, and the steep escarpment will be more or less obliterated. Over all this length the escarpment of the plateau, which is known in the south-west under the name of Great Khingan, and in the Okhotsk region under the name of Stanovoi (Jugjur), represents an extremely important orographic feature and a limit for the westward spreading of the Manchurian vegetation, and partly also an ethnographic boundary.

I.—§ 24. *The South-Eastern Plains and Lowlands.*—Immense plains spread at the foot of the plateau, to join further east the lowlands which border the Pacific ocean. The low plains of the south-eastern slope are lower than those of the north-western slope. They hardly rise above 1000 to 1500 feet in the nearest neighbourhood of the plateau, and from 800 to 1000 feet further east. In many places they assume the character of beautiful prairies, very fertile, and thickly populated in the Chinese Empire. On immense areas, with the exception of the banks of the rivers, they are covered with a small, half-shrub-like oak; rows of broad,

flat, and low hills intersect them, mostly following the same direction as the escarpment of the plateau.

We know such fertile prairies to the south of the Kalgan escarpment of the plateau, that is, in the neighbourhood of Pekin; all along the route that was followed by Archbishop Paladius from Pekin, through Tsitsihar and Merghen to Aīgun, that is, between the Nonni river and the Amur; on the middle course of the Sungari; on the lower course of the Bureya; and in the prairies of the Selinja, now peopled by wealthy settlements of Dukhobors. The Manchurian railway, from its station, Khingan, to the Lao-Tung peninsula, crosses these prairies.

§ 25. The main upheaval which we know amidst these prairies is the flat and broad succession of hills known as the Ilkhuri-alin, which, during the last Boxer uprising, was very often incorrectly described as the Small Khingan. Where I have crossed it, between Merghen and Aigun (50th degree of latitude), it attains nearly 3000 feet of altitude, and I found its surface covered with small volcanic craters and masses of basaltic lava. The Amur pierces it between the villages of Kazakevich and Bibikova; but its further continuation remains unknown, and it seems only probable that the Zeya pierces it above its junction with the Selinja, under 52° and 52½° of N. lat. Mounts Tabiarkhan and Jarakhan seem also to represent its further continuation. In such case it may appear that the Tylskoi range on the coast of the Sea of Okhotsk is also a continuation of these mountains.

§ 26. Another independent mountain range is the Bureya mountains, otherwise the Little Khingan, or the Dóusse-alin. It attains altitudes of from 4000 to 6000 feet, and has a width of over 50 miles. The Amur pierces it below the Cossack village of Ekaterino-Nikolsk. Its slopes are very steep, and its foot lies upon heights of nearly 1000 feet in the north-west, and 500 feet or less in the south-east. It does not, however, represent one single chain of mountains, but consists of several parallel ranges, very steep and reaching a considerable height, and is formed of granites and crystalline slates. It is well known in the place where it crosses the Amur, between Ekaterino-Nikolsk and Pashkova; at the sources of the Tyrmi, an affluent of the Bureya, and at the sources of the Bureya. Friedrich Schmidt has explored and partly mapped it. Its position on the left bank of the Amur is thus fairly well determined. As to its continuation on the right, or Manchurian bank of the Amur, I ventured in 1875 to express the opinion that this mountain range is crossed twice by the Sungari, in its lower course and above its junction with the Nonni river. This supposition has been confirmed since by the explorations made in Manchuria by the Anert expedition (see below).

§ 27. This mountain range seems to represent a boundary between the plains of the south-eastern slope (over 1000 feet high) and the lowlands of the same slope (below 500 feet), which reach the Pacific

ocean. At any rate, we find no high plains of the above-mentioned character in the east of this range of mountains: we see only marshy lowlands, covered with numberless lakes, in which the Amur and the Sungari and the Ussuri are still excavating their beds.

A few rows of hills, one of which is the Hokhtsyr, rise over the flat surface of these lowlands. The exact position of this range is, however, not yet settled. It is possible that it is pierced by the Sungari, and that its continuations separate the left-bank tributaries of the Tumen-ula (affluent of the Pacific ocean) on the one side, and the Hurkha and the Upper Sungari on the other side. As to the continuation of the Hokhtsyr beyond the Amur, it remains quite unsettled yet.

§ 28. Still less is known about the structure and actual position of the next mountain range, the Sikhota-alin. There is no doubt that these highlands may be traced without interruption in a direction from north-east to south-west, from the 49½° N. lat. to the Gulf of Peter the Great. Here it is probably interrupted by this gulf, but it seems to reappear further to the south-west, in the mountain range which separates the Ya-lu-kiang from the Pacific ocean; but whether all the highlands between the Ussuri and the Amur on the one side, and the Pacific ocean on the other side, are occupied by one single mountain range, or whether they contain several parallel chains of mountains, are questions which remain unsettled up to the present time. On the map accompanying this paper, I give them the positions which seem to result from modern Russian exploration. See the map reproduced in Suess' 'Antlitz der Erde,' vol. iii., in French translation.

§ 29. Finally, we see several outer ranges of mountains, partially submerged and partially raising above the sea-level, in the islands of the Pacific ocean. The positions and directions of these mountains remain unexplored. It may be that the southern portion of Sakhalin island is composed of one mountain range which has a meridional direction, as it is represented on our maps; but it is also possible, and even more probable, that the mountains of Sakhalin are not so simple as they seem to be at first sight, and that we shall find in this island the continuation of the mountains of East Siberia. It is very improbable indeed that the narrow width of the Tartar strait (between the continent and the Island of Sakhalin) should be quite accidental, and it is more probable, on the contrary, that on Sakhalin we should find continuations of the south-west to north-east upheavals of Sikhota-alin.

As regards the north-eastern extremity of Asia and the Kamchatka peninsula: On the road from Yakutsk to Okhotsk, the plateau of East Asia is reduced in width to less than 200 miles; but on its continuation we find massive upheavals or plateaux, of which the north-eastern extremity of Asia is built up. I mean the upheavals which give origin to the Kolyma, the Anyui, the Chaun, and the Anadyr. Their orographic character

remains unknown, but it must be remarked that the rivers flowing towards the Sea of Okhotsk from these heights are all extremely short, while the only great tributary of the Bering sea, that is the Anadyr, flows west to east, that is, almost for certain, in a longitudinal valley at the foot of this upheaval. As to the rivers flowing to the Arctic ocean—the Indighirka, the Kolyma, and even the Chaun—they attain a very considerable length, more than 700 miles for the first two. Such a hydrographic net seems to prove that we have a steep slope towards the south-east, and a very gentle one towards the north-west. In other words, it is very probable that we have here a continuation of the plateau, which we know in more congenial latitudes, and which at this extremity of Asia is considerably narrowed and has become much lower. Finally, in Kamchatka, we find, on a continuation of the Sikhota-alin, a mountain range which has the same direction from south-west to north-east, parallel to the Kamchatka river; and then we see, parallel to the shore-line of the Bering sea, a continuation of that mountain range. Another mountain range stretches between the south-eastern coast of Kamchatka and the rivers Bystraya and Kamchatka, and it contains all the now active volcanoes of the peninsula. This chain of mountains also has a south-west to north-east direction, and represents a continuation of the row of volcanoes of the Kurile islands.

The above-mentioned generalizations are confirmed by a number of cross-sections, and are illustrated by the subjoined map.

(*To be continued.*)

THE SWEDISH ANTARCTIC EXPEDITION.

I. SUMMARY OF EVENTS.

We print below a summary of the scientific results of the Swedish Antarctic Expedition of 1902–3, kindly communicated to us by Dr. Nordenskiöld. It is necessary, however, to preface this by an outline of the course of the expedition from the time when the *Antarctic* steamed north, on February 21, 1902, after leaving the leader and his five companions in the inhospitable neighbourhood of Snow hill, on the eastern side of the northward-pointing land-mass known as Louis Philippe Land. The first business which engaged the attention of the explorers was the erection of houses and observatories, after which an attempt was made to explore the neighbourhood by means of a boat excursion. It was soon found that the season was too far advanced for work of the kind, the movements of the pack placing the boat in frequent

danger. Enough was done to show that Seymour island, as well as that on which the winter station had been established, was divided from the mainland by a channel representing the supposed Admiralty inlet; but further exploration had to be postponed until the sea should once more be frozen over. The terrific gales experienced during the winter, and the work done during that trying period, are spoken of in Dr. Nordenskiöld's paper, and we may therefore pass on to the first important sledge expedition, which was begun on September 30, the leader being accompanied by Lieut. Sobral and the sailor Jonasen. Of the two sledges taken, one only could be pulled by the dogs, the numbers of which had sadly diminished by this time. Progress was therefore somewhat slow. It soon proved that the outer fringe of islands was backed by a continuous mainland, connecting Louis Philippe Land with King Oscar Land further south. The space between the islands was occupied by ice-plains, terminating in a precipitous ice-wall, and apparently resembling the surface of Ross's famous barrier in the vicinity of Victoria Land. The surface was generally smooth, but, as was found by the British explorers in the opposite hemisphere, the approach to the land was barred by formidable crevasses, rendering it impossible to obtain seal-meat for the dogs, so that it became necessary to begin the return journey on October 21, or earlier than had been anticipated, the station being again reached on November 4.

During the summer the gales ceased almost entirely, and little change in the ice occurred, this being the reason for the failure of the *Antarctic* to reach the station to take home the explorers. The second winter which they were thus forced to spend at the station proved far better than the former as regards the gales experienced, but the renewal of sledge expeditions, apart from some minor trips, was again reserved for the spring. On September 29, Dr. Nordenskiöld started, with the sailor Jonasen as his only companion, intending to examine the channels northward in the direction of Erebus gulf. This was reached on October 12, when the explorers unexpectedly met with Dr. Andersson and Lieut. Duse, who had spent the winter in that locality without any suitable equipment, having left the *Antarctic* at the end of 1902, in order to try to reach the winter station overland. They had since heard nothing of the ship. Returning in company to the winter station, they arrived in time to greet the appearance of the Argentine gunboat *Uruguay* (Captain Irizar), which arrived on November 8, still without news of the *Antarctic*. The very same night their fears for the safety of the crew were set at rest by the arrival of Captain Larsen and four men, who had made their way from the spot where the crew had wintered after the loss of the ship, the fate of which was thus for the first time made known to the other parties. The catastrophe had occurred when the *Antarctic* was about 20 miles south from Dundee island, the ship having been crushed by the ice-pressure caused by a

violent gale on January 10, and finally abandoned on February 12, the crew making their way amid great difficulties to Paulet island. The various parties being happily reunited on the arrival of the *Uruguay* at the last-named island on November 11, the homeward voyage was commenced.

II. SCIENTIFIC WORK AT THE WINTER STATION.

By Dr. OTTO NORDENSKIÖLD.

We arrived at the place selected for our winter station, at the foot of Snow hill, in Admiralty inlet, on February 12, 1902, and on February 21 our ship, the *Antarctic*, finally left us, not for some months, as we expected, but never to return. The members of the winter party, besides myself, were Dr. Bodman, meteorologist and magnetician; Dr. Ekelöf, physician and bacteriologist; Lieut. Sobral, of the Argentine navy, assistant meteorologist; and two sailors. As soon as possible the observations were started, and the scientific work was carried on without interruption until November 8, 1903, the day of the arrival of the Argentine Relief Expedition, commanded by Captain Irizar.

In the preliminary plan of the expedition the meteorological observations are entered as one of the most important parts of our work. But it is not only their intrinsic interest that makes me, in trying to give a general view of the physical geography of the region, begin with a discussion of our meteorological observations. In fact, not only is the climate of that region of specially great geographical importance, but there are some rather unexpected features that seem to lend that section of our results a peculiar interest.

The principal meteorological features of the region appear in the following table, communicated by Dr. Bodman, and comprising the *approximate* monthly means of temperature, barometric pressure, and velocity of the wind :—

	Temperature.	Barometer.	Velocity of wind.
1902.	° Fahr.	inches.	feet per sec.
March	14·90	29·25	30·84
April	7·88	29·31	23·95
May	1·40	29·12	36·74
June	−0·58	29·34	36·74
July	−11·92	29·29	36·09
August	−8·50	28·96	28·54
September	6·26	29·10	26·25
October	9·14	28·99	30·51
November	17·42	29·28	24·61
December	28·40	29·26	13·12

	Temperature.	Barometer.	Velocity of wind.
1903.	° Fahr.	inches.	feet per sec.
January	30·38	29·28	19·69
February	25·70	29·05	22·97
March	11·48	28·96	44·29
April	6·44	29·07	26·25
May	−2·92	29·18	19·69
June	−6·34	29·13	19·69
July	0·86	28·95	26·25
August	2·48	29·12	27·89
September ...	1·22	29·18	—
October	20·48	29·02	—
Mar. 1902–Feb. 1903	10·04	29·19	27·56

The minimum for the whole time was in August, 1902, −42°·16; the maximum, in the same month of August, 1903, 48°·74.

As other meteorological questions will soon be discussed more extensively by Dr. Bodman, I here restrict myself to those most important for the climate, viz. the temperature and the velocity of the wind. The first thing shown by this table is the unexpectedly low mean temperature. According to approximate calculations of our astronomical observations, the situation of the winter station was in 64° 22′ S. and 57° 0′ W. The nearest places where meteorological observations have been carried out during a time of sufficient length are at Cape Horn and in the region where the *Belgica* wintered, and from the results thus obtained we might have expected to find here a yearly mean of about 20° or 25° Fahr. Instead of this we obtained for the first year +10°·04 Fahr. Though it is possible that this temperature is somewhat lower than general, as the summer was undoubtedly exceptionally cold, and even the mean for the eight colder months (March—October) was in the first year 2°·3 Fahr., but in the second 4°, it does not seem probable that the difference from that general mean temperature should be even so great as between the two winters. A mean temperature of 10° Fahr. at the same distance from the pole is in the northern hemisphere found in the environs of Hudson strait, and in Siberia, in the region of Yakutsk, still one or two degrees further south. In both cases we see the influence of the extremely low winter temperatures of a continental climate, while for a thoroughly marine climate the temperature is unexpectedly low. It must be left to the discussion of the observations of the other expeditions contemporaneous with ours, including the *Scotia* Expedition, to discover whether there exists an especially cold area on the east coast of Graham Land, or even south of the Atlantic ocean.

The difference in temperature between summer and winter is, of course, not so great as in the regions mentioned, and, notwithstanding that the temperature of the three winter months was during the two years as low as −4° Fahr., the winter could not be called very cold if

it was not for the wind. The great violence of the wind in all Antarctic regions is a well-known fact, but I doubt if a violence such as that during our first winter has ever been experienced in an Arctic or Antarctic climate, and even the average for the whole time must be considered unexpectedly high.* However, the table shows that the differences between different seasons, and also between different years, are very great.

The factor that really determines the climate is the direction of the wind. The situation of the station, on the shore of a strait, may partially account for the predominance of the winds from the south-west and north-east quadrants. Besides this, there is a high percentage of calm or nearly calm weather. The south-west winds are by far the most common and the strongest, and because they are also the coldest, all the really bad weather is to be ascribed to them. The calm hours are not much warmer, but of course their influence on the general feeling is absolutely different. The real north-east winds are comparatively strong and cold; but, besides them, there is another class of winds which are, if not as common as the others, still exceedingly characteristic of the climate. They are the winds from north or even north-north-west, and when once started they are very strong and very long-continued, and bring the warmest weather. It is these differences that bring out another characteristic of the climate—its great variability. The variations from day to day are in winter-time greater, as in most other regions of the world, and, as far as our short experience goes, it is quite probable that this also holds good from year to year. Though the mean temperature of these two winters is nearly the same, the difference between the two is very great. In the first year the south-west storms were absolutely overwhelming, alternating with periods of calm, warmer weather. In the second year the calm periods were generally colder, and, at least during the first part of the winter, very common and long-continued, and to this cause during the second half were due long periods of warm northerly winds.

In the closest connection with that state of the weather stand the ice-conditions. After the winter of 1902, with its south-west storms, came a summer that was not only the coldest hitherto known in any region of the world, but also, and that to our bad luck, marked by an accumulation of ice such as never has been seen in that region. It was in the battle with that ice that the *Antarctic* was lost, but it may be said that we on the station had really no reason for uneasiness, as never, except perhaps for two or three days, was the sea in our neighbourhood so free from ice as to render the arrival of the ship probable. On the other hand, even in the middle of the winter, the north and north-west

* The only similar observations from the Antarctic hitherto published are those by the Borchgrevink Expedition (preliminary), the mean being considerably lower than ours.

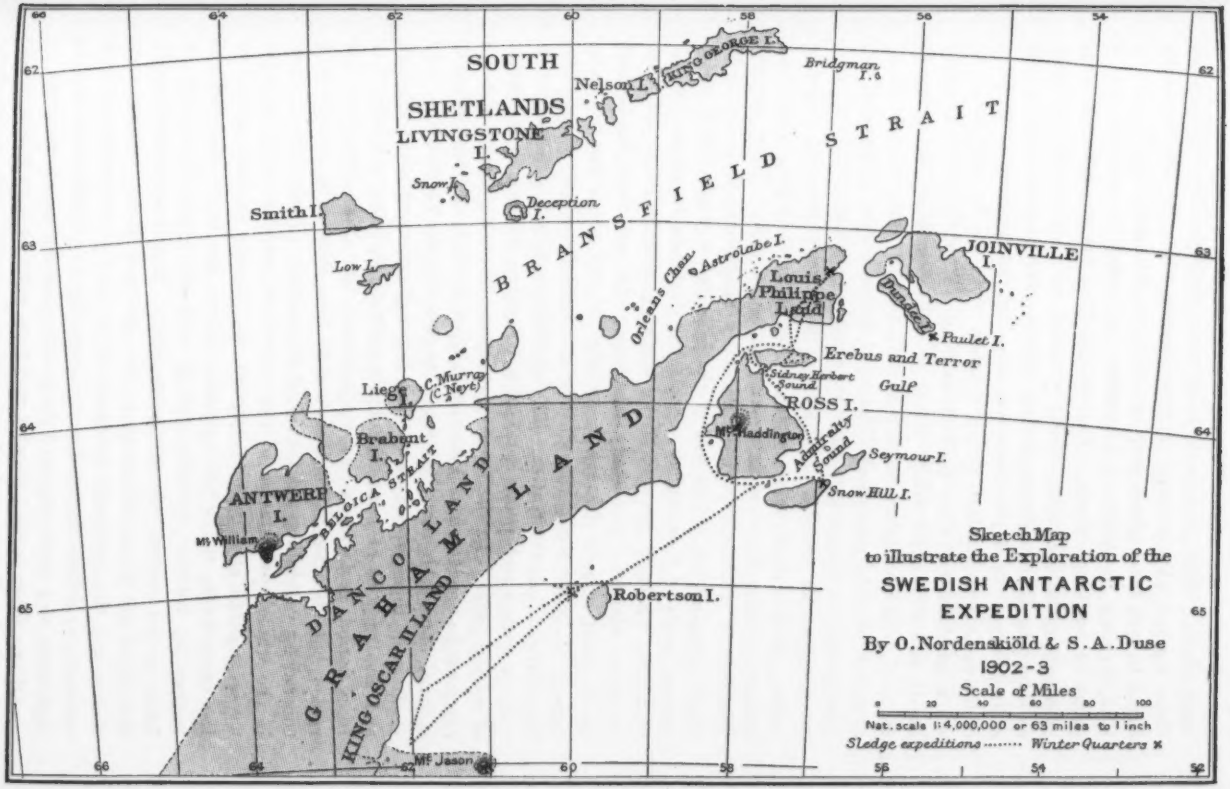
winds would cause large openings in the ice, and after the strong gales in August to October, 1903, the second summer started with an almost clear sea, and probably this year is of the same type as the summer of 1893–94, when Larsen made his well-known voyage south.

During our stay I brought together rich material from investigations on the ice, both sea-ice and land-ice, and especially that typical Antarctic ice-cap of Snow hill—its temperature compared with that of the sea-ice and the soil, its movement, surface structure, and stratification. Interesting is the great accumulation of snow during the summer 1902–3, which is important for explaining the formation of such ice-caps and their great extension in those regions: a few years such as this would cover the whole region with snow.

Because of this accumulation, the land-ice forms at all seasons an easy travelling road, and only where there are large crevasses it might be difficult to pass in summer-time. On the contrary, just as in the north, so also here the sea-ice is during the summer to a great extent covered by water, making the travelling very difficult. But even if this had not been the case, we could not have used the first summer for distant sledge-travelling, as we had then to wait for the return of the *Antarctic*, and later to provide ourselves with the supplies necessary for another wintering. All sledge-work, therefore, was mainly during the two springs. Its results have been the survey of the coast with its outlying islands from the end of Louis Philippe Land to our southernmost point in 66° S., 62° W. The accompanying rough sketch-map, compiled by Lieut. Duse, gives an idea of the general geography of the region rather different from older maps. As a matter of fact, the whole mainland from Louis Philippe Land past King Oscar Land forms a narrow strip of high mountainous land, the continuation of Graham Land. Further on in the same direction, Joinville island seems really an archipelago of islands. East of the mainland we find two other island groups, divided by the wide gulf extending between Snow hill and Robertson island.

The northern archipelago is divided from the mainland by a broad channel studded with islands. It consists of two groups, divided by Admiralty sound, with its two islands, Cockburn and Lockyer. Inside of this strait the principal mass of land is divided by a narrow winding channel into two large islands, the largest of which, with Mount Haddington for its highest point, I propose to call, after its discoverer, James Ross island. Though in cold summers the ice in those channels and straits does not break up, it is probable that there is in other years much open water.

Very different is the aspect of the southern "archipelago." No real islands exist here; even the mildest summer will not melt away the ice so as to allow a boat to come round any of the islands. All visible land consists of nunataks rising out of a high, extensive


SOUTH
SHETLANDS
KING GEORGE I.
Nelson I.
Bridgman I.
LIVINGSTONE I.
BRANSFIELD STRAIT
Snow I.
Deception I.
Smith I.
Low I.
Astrolabe I.
Orleans Chan.
Louis Philippe Land
JOINVILLE I.
Dundee I.
Paulet I.
Erebus and Terror Gulf
Sidney Herbert Sound
Liege
C. Murray (C. Neyt)
ROSS I.
Mt. Haddington
Admiralty Sound
Seymour I.
Snow Hill I.
Brabant I.
ANTWERP I.
Mt. William
BELGICA STRAIT
GRAHAM LAND
DANCO LAND
KING OSCAR II LAND
Robertson I.
Mt. Jason
Sketch Map
to illustrate the Exploration of the
SWEDISH ANTARCTIC
EXPEDITION
By O. Nordenskiöld & S. A. Duse
1902-3
Scale of Miles
0 20 40 60 80 100
Nat. scale 1:4,000,000 or 63 miles to 1 inch
Sledge expeditions ..... Winter Quarters ×

mass of ice. Still, I believe it is very probable that should once there come a change to a warmer climate, then the ice would be found to rest for a great part in a shallow sea, and not only on the land, forming in reality a connection between the mainland and a group of outlying islands. The mainland, so far as known, is composed of crystalline rocks, mostly granites, and also porphyries, and, as shown by Dr. Andersson, though perhaps to a less extent, of folded sedimentary rocks of pre-Cretaceous age. On the contrary, in all parts of the eastern archipelago young volcanic rocks are in predominance, while granitoid rocks are entirely wanting. What is found is mostly basalt, and to a great extent tufaceous rocks, sometimes belonging to types of great petrographical interest. I need not state that, as a consequence of this geological difference, the mountain forms and the whole aspect of the country show very marked contrasts.

Amongst the southern nunataks I have only observed volcanic rocks. Besides those, there occurs in the northern region, around our station, another far more interesting series of rocks. Those are the fossiliferous sedimentary rocks, generally sandstones, that are to be found cropping out at the foot of the hills below the volcanic series in most parts of Ross island, and also on Cockburn island, and which form the whole of the two large outlying islands, Snow hill and Seymour islands. The study of those rocks and their fossils will be of great interest for the knowledge of the conditions of those regions in former times, though it is, of course, impossible at this time to go further into the matter. The whole formation is generally very rich in rather well-preserved fossils, belonging to numerous groups of marine forms. In the lower part ammonites are common, and the age must be considered as Mesosoic; higher up those are wanting, and it is not improbable that the strata here pass into the Tertiary.

It is in those upper strata that I found numerous plant-remains, and also remains of some vertebrate animals, showing not only that in a period geologically not very distant land has existed in this region, but also that the climate was at that time mild, and the land covered by vegetation and inhabited by animals. There is in all this, in the whole configuration of the country as well as in its geology, a very marked analogy to Patagonia, and farther studies may prove the resemblance to be still greater. Even the inner channels are interesting, because of their analogy with the great plains and the lakes on the eastern side of the cordillera. But it seems undeniable that there are great differences in the structure of the southern cordillera and the Antarctic mountain chain, and more investigation is necessary to determine whether it is possible to consider this part of Antarctica as a continuation of the South American continent or not.

Of our other investigations I will here only mention the bacteriological work. Just as in the Arctic regions, bacteria are also here scarce;

but Dr. Ekelöf has made the interesting observation that in the upper layers of the soil there is to be found a comparatively rich flora.

Our studies came to rather an abrupt end with the arrival of the Argentine relief expedition, as we thought we had reasons to expect that we should have a good deal of the summer at our disposal. Still, the time has been long, and undoubtedly it has been an advantage that the scientific work could be continued two years instead of one.

III. THE SCIENTIFIC OPERATIONS ON BOARD THE *ANTARCTIC* IN THE SUMMER 1902–1903.

By Dr. J. GUNNAR ANDERSSON.

On November 5, 1902, the *Antarctic* left Ushuaia for the south. The ship had been thoroughly equipped for the coming cruise in the Antarctic sea; a full supply of coal was taken on board, together with some additional provisions in case of having to winter. A plan for a relief expedition was sent to Sweden and to the Scandinavian General Consulate in Buenos Aires.

As I had been told that coal had been recently discovered in Tekenika bay, in the southern part of the Fuegian archipelago, I so arranged our route southwards that we stopped two days in this bay to survey the coal-bearing formation. This led to an unexpected result. Instead of what I had expected to meet here, an isolated patch—like that in Slogget bay—of the Tertiary formation, with plant-fossils and lignite, which is widely distributed in northern Tierra del Fuego, and, in my opinion, more recent than the folding period of the Fuegian cordillera, I found a strongly folded sedimentary series, chiefly a conglomerate, with marine shells and trunks of driftwood. The sedimentary beds were traversed by eruptive dykes. Unfortunately, my collections from this place were lost with the *Antarctic*. For this reason I cannot give any definite opinion as to the age of the sedimentary beds nor the petrological character of the eruptions traversing them. Moreover, I have decided to return to Tekenika bay to survey in detail this locality, as it will evidently contribute to deciding the unsettled age of the Fuegian cordillera.

Late in the evening of November 7, the *Antarctic* crossed the latitude of Cape Horn to the west of Hermit island, and in the night of the 9th to 10th of the same month, in lat. 59° 30′ S., long. 66° W., we passed the first water-worn floes of drift sea-ice, the first iceberg having been sighted the previous day. As soon as we had entered the region of drift-ice, I started regular observations on the frequency and size of sea-ice and icebergs. These running observations were carried on by me up to my departure from the ship on December 29, and after that they were continued by Mr. Skottsberg.

On November 11–12 we met the dense pack in lat. 61° S., and

only after ten days' hard work did Captain Larsen force a way to the open coast water outside the South Shetland islands. Between Smith island and Snow island we entered Bransfield strait, practically free from ice. November 23–24 we visited Deception island, but found its crater covered by unbroken ice. From here we steered for the eastern end of Livingstone island, where a short landing was made. During all this time the weather was fine and clear. On the opposite side of the broad strait we distinctly sighted the snow-clad plateaus and lofty peaks round the Orleans channel—the old Trinity Land. But nothing was to be seen of Middle island, which is marked on the charts as situated in the middle of the strait between McFarlane sound and Astrolabe island; on the following day (25th) we crossed the position of the non-existing island, and here dropped the lead in 800 fathoms. On the previous day, in a sounding between Deception and Livingstone islands, in 534 fathoms' depth, we had found a remarkably low bottom temperature of 29° Fahr. An examination of the intermediate depths at the sounding station of "Middle island," gave the result that Bransfield strait repeats the typical hydrographical condition of all ice-bearing parts of the ocean—a superficial layer and a deep-water mass, both characterized by low temperature, and between them a body of relatively warm water. But this section shows two remarkable features: the intermediate warm current is here faintly developed, and in consequence a very large part of the section is occupied by the bottom water, the temperature of which is only 29·66° to 29° Fahr., the latter at the bottom itself. This bottom temperature is somewhat below the minimum deep temperature hitherto observed in the ocean (the Norwegian sea, bottom temperature 29·3° Fahr.), and it is quite exceptional in the south polar regions, the bottom temperature of the Antarctic ocean being about 31° Fahr. Evidently Bransfield strait is an isolated basin, separated from the open ocean by submarine shelves, which admit only a very limited renewal of the warm water. Later on in the summer we got more sections and single soundings in Bransfield strait. The maximum depth observed was 826 fathoms, near to Bridgeman island.

In January of the same year (1902), before establishing the winter station, Dr. Nordenskiöld, with the *Antarctic*, made a two days' excursion along the coast of Graham Land south-west from Astrolabe island. As a result of this visit, he was convinced that here runs a continuous coast-line, and that the Orleans channel of Dumont d'Urvile, and the Belgica (later Gerlache) strait of the Belgian expedition, form parts of the same far-extending channel. But the question was in some principal points unsettled, because of the difficulty of reaching an incontestable connection with the Belgian chart. Now, we had to clear it up decisively, and in the time—November 26 to December 5—Lieut. Duse carried out a survey on the scale 1 : 300,000 of the region

between Astrolabe island and Cape Murray (Cape Neyt of the Belgian chart). During this time the hard-working cartographer arranged the course of the ship so as best to suit his survey, we other scientists taking the chances thus offered for our own work. At every landing that Mr. Duse made to get bearings and astronomical observations, he was followed by the botanist and the geologist; Mr. K. A. Andersson, in the mean time, with trawlings from the ship, making collections of the luxuriant marine fauna. These days in the Orleans channel we remember as a most happy time of full and profitable activity, the only regret being that the larger mass of its rich collections no longer exists.

On December 5, the survey of the Orleans channel being finished, we headed for the sound between the mainland and Joinville island, in order to proceed to the winter station. Cheerfully we spoke of the approaching meeting with Nordenskiöld and his comrades, and preparations were made for their reception on board. But events turned out far otherwise than we expected, and many a lonely day had to pass before we reached our friends on Snow hill. The sound inside Joinville island we always found filled with heavy, hummocky drift-ice; and Erebus and Terror gulf, as far as we could sight it from the sound, looked like a dazzling white plain without a single space of open water visible. Here all efforts to penetrate the pack would evidently be useless, at least for the next few weeks, and Captain Larsen determined to try the outside Joinville island. On the northern coast of this island we again met the edge of the dense pack, which we followed in a northerly direction, eagerly looking for an opening to the east and south. South from the Elephant islands the *Antarctic* got caught by the ice, and drifted with it in a north-easterly direction. On December 15 (lat. 61° 35′ S., long. 53° 0′ W.) we had drifted outside the Bransfield basin, as was proved by a sounding at 892 fathoms, a bottom temperature of 31·28° Fahr., the normal deep temperature of the open Antarctic ocean. Two days later, the ice having slackened so as to permit the ship moving, Captain Larsen made his way back westwards to open water. We now returned to the sound inside Joinville island, only to find the ice-conditions here unaltered. The chances of reaching the winter station with the ship at this time seemed very bad, and we sought to realize a plan that had been under preparation during the last two weeks. On December 29, Mr. Duse, Sailor Grunden, and I were landed on the west side of the sound to try sledging round the gulf to get into communication with Snow hill. The movements of the *Antarctic* from this day to the final disaster will be reported by another hand.* The only thing that remains to tell here is the fate of the scientific materials on board at this time.

The most valuable part of our collections of earlier times by the

* See above.

expedition had been sent home from Port Stanley and Ushuaia. Before we left Port Stanley the last time (September, 1902), I had left another large part of our collections in charge of the Colonial Government and of the Falkland Island Company. All zoological, botanical, and geological material that could, if wanted, be worked out by foreign hands was deposited here. My private geological notebooks, as well as all the materials in charge of Mr. Duse (meteorological and hydrographical journals, cartographical material), were kept on board to be worked out in the course of the voyage. We are highly indebted to Captain Larsen and the two scientists remaining with him on board for saving all the notebooks, journals, etc. Only the cartographical material from South Georgia could not be found by them, and it was consequently lost with the ship. The collections made on the second visit to Tierra del Fuego were kept on board, and the most of these, as well as most of the collections obtained during that last summer's work in the south, had to be left on board when the sinking ship was abandoned. But it is much to the credit of Messrs. K. A. Andersson and Skottsberg that they, in the days when the fate of the ship was already evident, selected the most valuable, portable parts of their collections, which they took to Paulet island, and thus saved them.

IV. THE SLEDGE-EXPEDITION FROM THE "ANTARCTIC."

By Dr. J. GUNNAR ANDERSSON.

When, in the middle of December, we had found that the impenetrable pack in every direction stopped the ship in its passage towards the winter station, I determined to try to reach Snow hill by a sledge-voyage round Erebus and Terror gulf. Mr. Duse instantly expressed his desire to take part in the proposed trip, and also the third member wanted, sailor T. Grunden, joined voluntarily.

Without any special equipment for sledge-travelling, and starting along an unknown coast, we evidently entered on a rather doubtful and hazardous undertaking, but the situation required everything possible to be tried. As soon as the necessary preparations were made, we landed in a bay on the mainland (west) coast of the sound inside Joinville island, where a depôt of provisions was erected. Before the departure the following was agreed with Captain Larsen: that (1) if the sledge-party reached the station, we should wait there for the *Antarctic* until February 10, but after that date bring Nordenskiöld and his comrades out to our starting-point. In this case Larsen had to pick us up at the place agreed on between February 25 and March 10. (2) If the *Antarctic* reached the station, and we did not appear there by January 25, Larsen had to look for us at our depôt.

On the night following our landing, we started in a south-south-west direction across the inland ice, and on the second day we made an

unexpected discovery. Having reached an ice-shed, we faced a broad sound with scattered islands. This sound we had to cross to reach a snow-covered land lying some 22 miles distant in a southerly direction. The sea-ice was at this season in a very miserable state, covered with large fresh-water pools. These were getting deeper, and formed a regular network as we approached the last-named land, which we reached (January 3, 1903) only after a desperate wading and with all our effects thoroughly wet. After having climbed to the top of the gently sloping inland ice, we got a free view all round that cleared up our position. The land where we were standing formed in reality a large island on the north side of the water called by Sir James Ross Sidney Herbert bay, which in fact runs far inland, and joins our island inside with the broad water that we had just passed. Sidney Herbert sound was all over a bluish surface of water-covered ice, quite similar to that on which we had just had a narrow escape, and along the shores there were in some places broad spaces where the ice was entirely gone. As we could not think of crossing this sound, we could only give up our plan and return to the depôt, which we reached on January 13. Here the weeks passed without the *Antarctic* reappearing, and in the middle of February we began to make preparations for the chance that we might be forced to winter here. On March 10 the time to expect the ship was due, and the following day our stone hut was ready for use. The depôt had been established only for the time until the ship should return, and was thus insufficient for wintering. Some hundred penguins were killed to supply us with fresh meat, and seal blubber was used as fuel.

The winter passed without accident, but with a complete lack of intellectual employment. On September 29 we started again for the station on Snow hill, were stopped for three days in a violent snow-storm, and then went on slowly in unsettled weather. On October 12, travelling along the coast of the above-mentioned island, we, by a strange coincidence, unexpectedly met with Nordenskiöld, who had reached this region through a large interior channel just then discovered by him. Loading our effects upon his dog-sledge, we continued the journey pleasantly through Sidney Herbert sound and outside Mount Haddington. After four days' travelling in splendid weather, we reached Snow hill on October 16.

Our sledge-party was despatched from the *Antarctic* to fulfil a duty that we failed to carry out in face of natural obstacles which we could not master. The scientific results of our undertaking are very limited. Living during the winter in a misery of dirt and darkness, and wanting also the simplest instruments, we were unable to make any kind of observations. Still, our time was not spent totally in vain. We entered a virgin area, where Duse made a survey that forms a necessary link between his chart of the Orleans channel and the extensive cartographical

work executed by Nordenskiöld and Duse together farther south on the east coast.

In the Orleans channel I collected some facts, adding to the evidence brought forward by Mr. Arçtowski, and proving that the large channel was once filled by an immense glacier moving in a north-east direction. Near to our wintering-place I found some other and very striking traces of an earlier wider extension of the glaciers. This material will soon be published, in combination with my observations from South Georgia, the Falkland islands, and Tierra del Fuego.

On the geological survey of the vicinity of the bay where we wintered, I made another noticeable find—well-preserved plant fossils, cycadas, conifers, and ferns, a flora of apparently lower Mesozoic age. A small selection of this material was brought with us on the sledge to Snow hill, but the great mass was left at our winter place, and afterwards picked up by the Argentine relief ship.

Our involuntary wintering brought also a certain practical result. By force of circumstances, living principally on the products of surrounding nature, and, like Nansen and Johansen in Franz Josef Land, in many respects following the mode of life of the Eskimo, we, together with the party wintering on Paulet island, accumulated an experience, new for the Antarctic regions, which, when once fully described, might be of service to future explorers in distress during the survey of the desolate and stormy southern lands.

To me it was of special interest to get intimate around our wintering-place with a nature so different from the now well-surveyed region round the station on Snow hill. Instead of its unfolded tableland surrounded by a shallow sea, we have here a deep sound with fjord-like bays swarming with a rich fauna, and a land with numerous edged nunataks rising through the inland ice—a folded region with such a variety of sedimentary and eruptive rocks, that the find of a rich Mesozoic flora is only to be regarded as a first hint of the possibilities of a future more extensive exploration. In the lonely winter months I sometimes amused myself with sketching in detail a survey of the geology and biology of this region, a plan that, I hope, will not wait long for its realization.

JOURNEY TO THE RENDILE COUNTRY, BRITISH EAST AFRICA.*

By H. R. TATE.

THROUGH the courtesy of the Foreign Office we have received the account of an interesting journey carried out last year by Mr. H. R. Tate, a collector in the East Africa Protectorate, through some of the least-known districts in the north-east portion of that territory. Mr. Tate

* Map, p. 280.

has been the first European to penetrate from the south into the heart of the Rendile country, east of Lake Rudolf, although this had been previously visited from the north, both by Dr. Donaldson Smith and Count Wickenburg.* Some of the most interesting work was done, however, during the earlier stages of the journey, which led from Lake Nakuru in the rift-valley, across the Laikipia uplands and the region north and north-west of Kenya, which has been little visited since the journeys of Joseph Thomson, Teleki, and Gregory. The statements of Mr. Tate confirm in a general way those of Joseph Thomson with regard to the general features of this district, on the correctness of which some doubts have since been cast. In the following pages we give a somewhat condensed version of Mr. Tate's narrative, keeping as far as possible to the traveller's own words.

Mr. Tate started from Nairobi on August 8, 1902, proceeding, however, as far as Nakuru before leaving the beaten track. His caravan consisted chiefly of Kikuyu natives, together with a few Somalis, three Dorobo guides, and an escort of forty men—half Sudanese, half Swahilis—under Lieut. Barrett. At Nakuru a Mnyamwezi guide was obtained, and a final start made on the 14th. Mr. Tate says—

"Taking our own line eastward, we struck out for the escarpment which runs northward from Kijabi to Laikipia, and after a stiff climb, camped on the plateau lying along its summit, where a cold moist atmosphere reminded us we had reached higher altitudes. There is excellent grazing and plenty of water on the plateau, and the Masai pasture large herds of cattle and sheep here when the plains below are burnt with drought. Thickly timbered forests alternate with deep grass valleys, the former much frequented by elephant, and the view from the summit allows the eye to roam from Mau southward over the great plains which lie around Nakuru, Elmenteita, and Naivasha. Still marching eastward, we reached the Ngatabus valley on the 17th, and found ourselves under the shadow of the Aberdare range, known to the Masai as Donyo Lereko, 'the mountain of red clay.' Here we struck northward to avoid the Elbollosit swamp, and did not resume our original course until the latter was crossed on the 19th. The Ngatabbus valley,† which runs northward from Mianzini to the equator,

* Mr. Tate does not seem to have had with him Dr. Donaldson Smith's narrative, and he was therefore misled at first as to the locality of the chief habitat of the Rendile, which was correctly placed on the American traveller's map. For an account of Count Wickenburg's journey, see the *Journal* for December (p. 698).

† This is evidently the Angata Bus of Thomson, the Rangatan Busi of Gregory, and apparently also the Ondagobbus of Mackinder, who places the district on the upper Morendat river, south of the El Bor Lossat lake. It has hitherto been shown as occupying the outer step of the plateau, between the Aberdare range and the rift-valley, and, if it extends south to Mianzini, would seem to be merely a shallow depression of the plateau surface, and not a true valley, for it will be drained in different parts by different streams. That it is drained in the north by the Ururu river bears out in part Thomson's delineation of the features of this district.

is thickly covered with the 'manyata,' or villages of the Masai, who pasture their herds all along its length. We found an elephant ford through the Elbollosit, which, though up to the armpits and bitterly cold, enabled us to cross in comparative safety, despite the immersion of a few loads of rice. From the swamp northwards a stream called the Ururu runs to the Guaso Narok, which in turn empties itself into the Guaso Nyiro.

"From here we marched eastward, and, crossing the northern end of the Aberdare range, camped on the plains at Lashao * on the evening of the 19th. Here we got our first view of Mount Kenya, which proved henceforward a valuable landmark to our caravan, and the next day struck north-east, first over the high plateau which runs north-west from Mount Settima,† and afterwards through trackless jungle downwards to the Longobellian streamlet, where a tiny water-hole just sufficed for the needs of our caravan. For the next three days we marched north-eastward over rolling plains covered with long waving grass, drenched with dew for two hours after sunrise. We saw traces of Dorobo, but as they are of the shyest of African tribes, they probably hid at our approach, and we found their villages empty on our arrival. Here game was most plentiful, fresh traces of elephant being everywhere apparent, and rhinoceros, giraffe, eland, and *Oryx beisa* frequently seen.

"On the 24th we passed Donyo Lol Girri-girri, a well-known landmark to Laikipia Masai, and found in a deep valley the Guaso Nyiro, or Brown river, running swiftly north-eastward, to be joined later by the Guaso Narok, or Black river, when the united stream flows in a turbid race to the Lorian swamp. The Guaso Nyiro is joined by a small stream from the south-east called Guaso Nyuki (Red water), not far from where we crossed. Hence our guides led us south-eastward for two days in order to strike an old cattle track which passes to the south of Donyo Lol Deiiga,‡ so called from its fancied resemblance to the pigtail of an Elmoran. From this mountain we marched almost due east."

Mr. Tate now changed his route somewhat in order to replenish his supplies in the thickly populated Mnyiso country, where food was cheap and abundant. Here, on September 1, the first natives were encountered since leaving the Elbollosit swamp. The country is covered with banana plantations, and the people were friendly and ready to sell provisions. The people, like those of the neighbouring district of Mzara, are of mixed Kikuyu and Masai origin, with a sprinkling of Akamba who have come north across the Tana, the language spoken

* Shown on Thomson's, Von Höhnel's, and Gregory's maps.

† Presumably the Markham Downs of Mackinder; yet these form the northern end of the Aberdare range, which was crossed on the previous day.

‡ Apparently the Donyo Endika of Thomson, north of Kenya.

being more akin to Kikuyu than any other tongue. The presence of the Masai on the west of Kenya has prevented a similar migration on that side, but it is evident that Meru, as all the cultivated country north-east of Kenya is called, has been gradually settled by a northward movement from the south-east side. In Makandini, the most southern community of Meru, the Kamba tongue is spoken in an almost pure form. Between Mnyiso and Mzara there is a considerable settlement of Masai from Laikipia, who now form an agricultural unit of Meru, and have grafted the present strain of Masai blood among the Kikuyu and Kamba settlers. The country is extraordinarily fertile, being blessed with an ample rainfall, but, as is always the case where the banana is the staple food, the people are lazy and cowardly, and have allowed all their cattle to be carried off by the Elburgu (Masai). The men go nearly naked, and carry formidable stabbing spears, which they are said never to use. The women wear skins like the Akikuyu, and resemble both these and the Akamba in face and figure. The villages are built in the Kikuyu style, the raised grain hut being seen in every village. Meru is a grain-centre well known to native caravans going to and returning from Rendile and Massaini.

Mnyiso was left on September 2, and camp pitched the same day at Mzara, the people of which are distinctly more courageous than those of Mnyiso. Here was the camp of Mr. Neumann, the elephant hunter, who was himself away shooting on the plains. The further journey is thus described. "Striking north, we followed the Guaso Marra stream across the great plain which separates Kenya from the Guaso Nyiro. Here we first encountered the terrible lava stones which are strewn broadcast over all the country north of Meru, and continue along the Guaso Nyiro to within six days of the Lorian swamp, besides being strongly in evidence in many localities north of the river, and very thick in Samburu and Rendile. The plains between Meru and the Guaso Nyiro are covered with thick herbage and dotted with game—a sure sign of good grass. Formerly the Rendile and Samburu pastured their herds all along the river, but, having been raided by the Masai, they retired 15 miles further north and have never returned. The Guaso Nyiro, where we first struck it, is about 50 yards wide, runs fairly swiftly, and has its banks thickly bordered with the dum palm (*Hyphæne Thebaica*). On the left bank we found small ranges of mountains and conical hills, followed by a rolling, granite-strewn, jungle country as we go further east. Along the right bank stretched more level and opener country, which in rain-time must be covered with good herbage and haunted by much game. Flat-topped acacia trees are dotted here and there through the grass glades. Both elephant and buffalo dung was frequent in this neighbourhood, but of buffalo we got no sight during the whole trip, though a big herd of about seventy elephants was browsing in a valley close to our path one day when we were not

expecting them. I was surprised to notice that elephant feed freely on the leaves and fruit of the dum palm."

The Guaso Nyiro flows first north-west, and is joined by the Guaso Narok before turning north-eastward. The Guaso Marra, a small though permanent stream, is said to be the only other confluent in the dry season until it reaches Lorian. Though turbid, the Guaso Nyiro is excellent drinking. Its volume is considerable, but rocks and rapids make it unnavigable, though the locality of the Chanler falls could not be discovered. Mr. Tate considers it probable that, after entering the Lorian swamp, its water passes underground through Tabtu, Afmadu, Kumbi, and the Deshek Wama to the Juba, the permanent water at these places being otherwise difficult to account for.

The river was crossed on the 8th by a good ford about 50 yards wide. "By the 11th," Mr. Tate says, "we were only five days west of the Lorian, as our guides informed us. Leaving the Guaso Nyiro behind us, we now struck northward, and our troubles forthwith began, and increased day by day as we reached farther north. The country between the Guaso Nyiro and Rendile consists chiefly of huge arid plains, dotted with stunted acacia trees and thorn scrub, varied occasionally by rolling uplands and extensive plateaus bounded by sharply defined escarpments. The face of the country is so uniform in appearance that the Unyamwezi guide had considerable difficulty in picking out the route followed by the trading party with which he had previously travelled. Added to this, we were travelling at the end of the dry season, after a two years' drought, as the Rendile subsequently informed us, in a climate fully as hot as that of the Taru desert. I adopted the plan of sending our guide with two other men six hours ahead of us every day to search for water. The caravan followed in their wake, starting as a rule at sunset, and, favoured by a good moon and clear sky, we generally followed their spoor for five hours, camped on a hill where a big fire was lighted, and awaited the return of our scouts. If water had been found ahead, we marched to it at daybreak; if the contrary, a return to the last camp would be necessary, but I am glad to say that, thanks to our extraordinary luck, we never had to adopt this latter course."

Between the Guaso Nyiro and Rendile, during a period of eleven days, no running water was found except at the hot springs of Ngare Leruwa, and here it disappeared again in about 300 yards. This water, which had a strong sulphurous taste, bubbled out of the level ground at a temperature slightly below boiling-point, and was clearly of volcanic origin. It was evidently appreciated by the game in the vicinity, which included elephant, rhinoceros, zebra, giraffe, and *Oryx beisa*. Grévy's zebra and gerenuk (*Lithocranius walleri*) were here identified for the first time, and the first traces of Samburu villages were found. Water was generally obtainable only by digging 4 to 5 feet in the dry

river-beds. That at Seri Merili was more than ordinarily salt, but was said by the Masai to possess fattening qualities. On September 19 Lesamis * was reached, but the expected Samburu encampment was found to be deserted. It was now the fortieth day since the start from Naivasha, and rations were getting alarmingly low in view of the fact that they could not be replenished until Mnyiso was again reached. Despite the length and severity of the marches, the conduct of the troops and porters had been quite exemplary, and all bore their various hardships with heroic cheerfulness. Yet it was felt that, unless prospects improved, a return would be almost immediately necessary, with the objects of the expedition unaccomplished. By a providential chance, however, ten Akamba were met with, who had been trading in Rendile, and had only left the country the day before. They agreed to act as guides to the caravan. At Lesamis, which is situated on a stream of the same name, with pools of water frequented by Grévy's zebra and other game, drinking-water may be obtained in the dry season by digging down about 3 feet. Between this and the Rendile highlands stretches a desert of 40 miles known as Kohiti, the passage of which involved immense hardships. Marching during the night and following morning—in part under a burning sun—the caravan halted in a thorn coppice within sight of the grassy slopes of Rendile, which rose in terraces to the summit of Haldaiyan. The march was resumed by moonlight, the water being now all spent; but shortly after midnight the men were dead beat, and it became necessary for Lieut. Barrett to push ahead with volunteers and bring back water for the rest of the party. This enabled the caravan to reach the Reti wells on the morning of the 21st, and camp was pitched above a huge dry watercourse, the banks and bed of which were strewn with huge shapeless lava blocks. Excellent water was here obtainable from half a dozen wells some 6 feet deep, where countless herds of sheep and goats were watered daily. The Samburu people met here are thus described by Mr. Tate: "On our arrival at the Reti wells we were met by about a dozen Samburu elders with grass in their hands, who saluted with the word 'Serrian,' meaning 'well.' They spoke pure Masai, and I found out from Lenana on my return to Nairobi that they were really Laikipia who had migrated north to the Guaso Nyiro about a generation and a half ago, and from their habit of constantly changing their feeding-grounds had received the name of 'Samburu,' which means 'butterfly' in the Masai language.† The Samburu have

* This place was visited both by Dr. Donaldson Smith and Count Wickenburg, and the further route appears to be much the same as those followed by these two travellers.

† It will be remembered that the name Samburu was long applied to the great northern lake, before the expedition of Teleki and Von Höhnel brought back an accurate knowledge of Lake Rudolf.

intermarried with the Rendile, and many of them speak their language, although they still retain many of the characteristics and customs of the Masai. They are, however, a far more suspicious and timid people. They carry a slender, leaf-shaped spear, a curious oblong shield about 3 feet in length, and a large bow and arrows. The men wear a loose garment of white sheeting, dyed brown, which they wrap around the upper part of their body, the usual wrist and ear ornaments (though the latter are always of metal, and of a much lighter weight than those in use by the Masai), and a necklace of green, black, and white beads in descending coils around the neck. In stature they are heavier made than the Masai, no doubt owing to the invariable strain of Rendile blood in their veins. The elmoru, or elders, wear the hair short, but the elmoran (warriors) have a fringe and allow the hair to grow long behind, but do not bind it in a queue. In face they lack the aristocratic profile of the gaunt Masai, but their expression is pleasing and intelligent. The kopo (old women) and ndito (young girls) dress in the same style as among the Masai people."

The Samburu country proper, which extends from the Seri Merili to the Reti wells, is a very dry one, though the grass on the uplands is nutritious and sweet. Dried watercourses and ridges covered with broken quartz or boulders of gneiss alternate with plains strewn thick with lava stones, and dotted with flat-topped acacias. The people, when living on the Guaso Nyiro, had been much harried by the Elkumi and the Elburgu Masai, and had therefore retired to Rendile. This country begins north of the Kohili desert, and the Reti river is consequently not, properly speaking, in the Samburu country. The ground slopes gently upward to the Haldaiyan hills, the highlands around which are clothed with fine grass. The climate is bracing, and the morning mists temper the sun's heat. Water is, however, scarce. Mr. Tate was visited by Lassarge (also known as Lubu), chief of the Rendile, and Lamarru, an influential elder, both of whom had been seen by Chanler at Komi. Lassarge, with steel-blue eyes, possesses rather small features of an oriental type, while Lamarru exhibited the high cheek-bones, hooked nose, and prominent chin of the Semite. His eyes were also of a bluish tint. The Rendile, who speak a corrupt form of the Galla tongue, have probably emigrated from the east, driven thence by raids of the Ogaden Somalis. In face and habits they resemble the Gallas so closely that it seems impossible to doubt that they are an offshoot of this tribe. When the original exodus of the Gallas from the east took place, the first settlement seems to have been made in the Boran country north of Lorian. Increasing flocks and herds and a naturally arid country compelled a further move westward to the Rendile country north of the Guaso Nyiro, while the people who now occupy the eastern shore of Lake Rudolf made the last move of the tribe to their present locality. The repudiation by the people themselves of their Galla

origin is probably due to the fact that they are much raided by the Boran Gallas, with whom they have no wish to claim relationship.

The Rendile possess immense herds of camels, which constitute their chief wealth, though they possess also considerable flocks of sheep and goats. A man is considered poor if he does not own more than one hundred camels. They are arrant cowards, and never retaliate on their raiders. They wear a longish garment of "marduf," or American drill, with great quantities of beads round the neck, metal earrings, brass wristlets and anklets, and camel-skin sandals. The young men carry an oblong shield of giraffe-skin, which has evidently been copied by the Samburu, and two leaf-shaped throwing-spears; the older men have a longer oval spear and bows and arrows. They are all circumcised, and the navel is cut as by the Marli north of Lake Stefanie. No trace of Mohammedan influence was seen among them. The Rendile live entirely on milk and flesh, both of camels and sheep, but in appearance are attenuated, their fare being apparently a meagre one. A striking peculiarity is the steel-blue eyes possessed by a few members of the tribe, those of the majority being brown, of the same shade as among the Gallas. The Rendile settlement on Lake Rudolf, though not in constant communication with eastern Rendile, is only a three weeks' journey to the west, and many of the Samburu have travelled so far. The Rendile villages resemble those of the Somali in every detail.

The last six days in the Rendile country were spent on the shores of Lake Sogorti, which lies amid dense forest in an old crater on the summit of the Haldaiyan hills.* The path led up through thick woods of beech and juniper, and debouched suddenly on the lake, at which hundreds of camels were being watered at the time, forming a strange picture, the effect of which was heightened by the lowing of the animals, the shouts of the herdsmen, and the shriller cries of the women, who were filling their water-gourds. The circumference of the lake is about 2½ miles, and the country all round is strewn with huge iron-stones and lava.

The return journey was commenced on the 29th, and the passage of the Kohiti desert was made under similar difficulties to those experienced on the outward march. Mnyiso was reached by some fine marching, 210 miles being covered in twelve days. Kenya was sighted on October 12. It is known to the Rendile as Eldonyo Burgos, "the white-necked mountain," and to the Samburu as Eldonyo Lorgenai, "the mountain of black stones," in allusion to the lava on its summit. The Akikuyu call it Kitira and Kirima nyaga, "the beautiful mountain," the Akamba Killi Nya; and the Masai Eldonyo Geri, "the striped mountain." † Supplies were once more procured at Mnyiso on October 15

* This crater lake is marked on Dr. Donaldson Smith's map.

† For other names of the mountain, see *Journal*, vol. xvii. p. 305.

and 16, and the march southward was continued by the route to the east of Kenya, which had been little travelled by white men.* Mr. Tate thus describes this part of the journey—

"We found that cultivation continued for about 20 miles south of Mnyiso, and ended at the Zingizi stream in the Makandini country. After crossing this, the face of the country changes. Instead of close cultivation, fresh herbage, and frequent mountain streams, small conical hills arise on every side, around which the stony path winds over red granite rocks and sharp-edged boulders. In the dry season there is no water between the Zingizi and the Tana river (if we except a few wretched water-holes in Thaka), a distance of 30 miles, but we were fortunate enough to pass through just after some heavy showers, and found water in a rain-pool close to our camp. From here onward the path follows a tortuous course through the villages of the Thaka people; along dry river-courses whose beds are half choked with huge boulders, up stony hill paths, and for the last 3 miles an absolutely precipitous path descends sheer down to the Tana, passing over the worst obstacles in the shape of huge rocks that we had yet experienced. . . . I earnestly advise all caravans to avoid this route, if possible, in passing from Kitui to Meru. The Thaka country extends along the north bank of the Tana river as far west as the Mutonga stream, which is said to come from Embo, and empties itself into the Tana between Mbe and Thaka. The people of Thaka are, with the exception of the helot Boni tribe on the Juba river, the most uncivilized that I have yet met in East Africa. The men go naked except for a small bunch of fibre, which depends from a belt of the same material. They carry bows and arrows, an axe, a knobkerry, and a few of them leaf-shaped spears. Many of them are merely wandering hunters, and have a bad reputation amongst traders. They are a Kamba tribe who have been forced by drought and famine to emigrate north. . . . They are always short of food, and seldom have any grain to sell to passing caravans." †

At the Mumoni ford the Tana (called Sagana by the Akikuyu, Kiloluma by the Akamba) is about 150 yards wide, and the crossing is difficult. Following the left bank, Mr. Tate found that the river became narrower, running in rapids over huge rocks and between high cliffs, while the thorn jungle along its banks was very dense. The long range of the Mumoni hills was a conspicuous feature on the opposite bank. On the 22nd the Mbe country was entered, and Embi on the 23rd, Fort Hall being eventually reached on the 28th. During the whole expedition a route survey was carried out by Lieut. Barrett, of whose map the accompanying sketch is a reduction.

* The mapping of the eastern side of Kenya has depended hitherto mainly on the work of Dr. Kolb (see *Petermanns Mitteilungen*, 1896).

† An account of the Wathaka is to be found in Mr. E. Gedge's paper on "The Exploration of the Tana," by Captain Dundas (*Proc. R.G.S.*, 1892, p. 524). The Thaka country is called Saka by Dr. Kolb.

THE IMPETUS AND DIRECTION OF GEOGRAPHY IN THE NINETEENTH CENTURY.*

By Baron F. von RICHTHOFEN.

I.

THE object of geography is the study of the Earth. Its data are obtained from observations of the Earth's surface. Its bounds widen with the area explored and with the intensity of investigation. Hence, at all times an extension of the field of vision has stimulated interest and promoted the collection of data, while impulses of quite another kind have determined progress in the deepening and exact comprehension of observations and in scientific work.

Various motives have been the basis of human activity, which in the long course of time have led to the widening and illumination of the field of vision, which in the past century embraced almost the whole surface of the Earth. The majority of these motives have always existed, and but few are due to the development of scientific methods. The most elementary is the spirit of adventure, forcing man by some unconscious inner power to fight the dangers of the unknown, and this has governed many from the days of Pytheas to the African explorers of recent years. The search for treasure is another motive which has led to the extension of the known. Of precious metals, stones, or spices, which have been lodestars to many adventures, gold has been the chief. Trade has been a less important factor, for from early times a knowledge of routes and markets has usually been confined to the interested parties (cf. the scanty knowledge of Phœnician routes and trade obtained by their neighbours). Trade has served to develop relations between peoples, and to bind together their reciprocal interests, but the trader himself has really never directly promoted the scientific study of the Earth. In opposition to this we may set the desire of civilized powers to acquire fertile lands within their ken or to control trade routes. This has been a powerful factor in extending the bounds of the known world and of throwing more light on the known part. History is filled with examples. Territorial expansion by war brings new lands into the new sphere of influence, and gives a new base from which to obtain information about the region beyond. Since the discovery of America, colonial expansion has brought an interest in the wider world to many a narrow home, but in counting the value of colonies such imponderable matters are too often left out of account. Special embassies have not infrequently extended and clarified geographical knowledge; for instance, those of Carpini and Rubruquis. Missionary travels have been of very varying significance from a geographical point of view, Livingstone's travels are among the best. Pilgrimages to religious sites and centres awaken and spread an interest in distant lands. Those to Mecca need only be cited. Mission work has been most valuable geographically when religious efforts have been combined with political ones, *e.g.* the Jesuits in China in the time of Louis XIV. Lastly, there is the desire for knowledge in the individual, which inspires an Ibn Batuta or a modern globe-trotter at the one end and the scientific explorer at the other.

II.

Almost up to the beginning of the nineteenth century knowledge of the Earth, whether personal or based on the growing information, was utilized in three ways.

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* An abstract of the Inaugural Address by Baron F. von Richthofen as Rector of the University of Berlin. 'Zeitschrift der Gesellschaft für Erdkunde zu Berlin,' 1903, No. 9.

1. Practical considerations naturally led to the recording of visible lines, especially of the coast-line near harbours. The word "geography" was first used by the Greeks only in the sense of this graphic representation. The early development of mensuration and geometry helped. In view of the fact that by 200 B.C. Eratosthenes had calculated almost correctly the diameter of the Earth, it is astonishing that it took four hundred and fifty years—from 300 B.C. to 150 A.D. —to pass from the idea of drawing the parallel of Rhodes to the construction of a network. Then the progress of cartography was arrested. The Arabs did not reach as far as the Greeks. One thousand three hundred years after Ptolemy, his network was used again, and, with Marco Polo's tale and the utilization of the compass, led to the discovery of the New World. This gave a motive for a further advance. Yet in all the period of maritime discovery, the second phase of which ended with Cook's voyage in 1780, the old ways of map-making traced by the Greeks were followed. Greater exactness resulted from the development of astronomy, improved arts and instruments of navigation, the use of triangulation for land surveys, new map projections, the discovery of the polar flattening of the Earth, and improved processes of drawing and reproduction. In comparison with that of the Greeks, it was a rich and exact map which was available at the beginning of the nineteenth century, but it lacked a representation of relief, without which a map is a mere skeleton.

2. The *written records* are unequally imperfect, and show the effect of periodic extensions of the horizon of the known. We descry in Herodotus and in Strabo the practical importance of the information. The rapid extension of the political horizon of the Arabs gave rise to many encyclopædic geographical works, but they are not so philosophical or critical as those of Strabo. From the thirteenth century compendia of knowledge appeared among Christian peoples, containing many wonders, but little understanding. The general encyclopædias of Vincent de Beauvais (1250), Konrad von Megenberg (1349), and Petrus de Alliaco (1410), show improvements. Sebastian Münster's 'Kosmographei' (1550) is characteristic, but a real step forward was made by Athanasius Kircher in the seventeenth century, while many dry *repertoria* appeared in the eighteenth.

3. Interpretation was begun by the ancients. The distribution of heat and cold in zones, winds, periodic floods and their connection with rainfall, the relations of rain to the ocean, alluvial deposits, coastal changes, and tides were taken into account. No further progress was made before the middle of the seventeenth century. It required such a man of genius as Bernhard Varenius, whose 'Geographia generalis' appeared in 1650, to write this the first work on the subject, one of which Sir Isaac Newton thought so highly that he prepared an English edition. Humboldt was the first to step in his footprints. In the interval Halley drew a map of lines of equal magnetic declination in 1701, Hadley propounded the first wind-law for the trades, Bernouilly and Euler studied oceanic movements and applied mathematics to phenomena of physical geography.

The art of observation was gradually learned, but phantasy was rife in the *à priori* eighteenth century. Kircher's 'Mundus subterraneus' (1665) gave the idea of an *ossatura globi* which prevailed for a century. Buache's (c. 1750) framework of the Earth has still its relatives in modern Germany, and influenced Humboldt. The catastrophe theory of Pallas and Buffon, and the fights of Neptonists and Plutonists, witness to the desire for explanation. Right observations were extended by theoretic extrapolation. The data for genetic knowledge was lacking.

In the last third of the eighteenth century, the philosophy of Kant, the development of natural philosophy and of chemistry, exhibited the intellectual progress. A

knowledge of the significance of questioning nature by experiment led to doing so by observation, as the work of Linnæus testifies. Celsius observed the movements of the Swedish coast-line, and about 1760 the Cosmographical Society was founded in that country, leading to the publication of Bergman's 'Physical Description of the Sphere.' About 1780, Zimmermann concluded, from his researches into the distribution of animals and man, that there had been changes in the distribution of land and sea. Deluc, in 1772, gave the means of using the barometer to measure heights. De Saussure observed the folding of strata in the Alps. Hutton indirectly arrived at the explanation of the chiselling of mountains by observation of actual dynamic operations; and Werner formed a school for the better ordering of the sequence of geological formation.

III.

With the nineteenth century came, in the person of Alexander von Humboldt, the man who first fully combined the scholar and the scientific explorer. He was the founder of geography as a natural science. Three hundred years after the discovery of America he discovered it anew for science. His aim was not simply to observe phenomena for themselves, but also to investigate their causal relations. He advanced not merely general geography, but all parts of geography. Land-forms, outer and inner structure of mountains, the way they are arranged, the trend of the coast, thermal conditions of the atmosphere both in horizontal and vertical planes, their relationship to the distribution of plant species and formations, terrestrial magnetism, internal heat, volcanoes, are among the problems he tackled; but his interest extended to the connection between surroundings and world situation to human distribution, settlements, and lines of communication. With a marked taste for comparative philosophy and history, he also, for the first time, studied the history of geography and of discovery in a truly scientific way.

As Humboldt taught for only a short time, he founded no school to carry on his work; only from 1833 to 1836 Friedrich Hoffmann lectured on physical geography in Berlin.

In spite of marvellous progress and division of labour, the content and method of geography are very closely related to the meaning given to them by Humboldt. Progress has been irregular, and more in illuminating than extending the field of investigation. In the scientific voyages of the first sixty years geography played a small part. Later the *Challenger* and other expeditions added more to our knowledge of the ocean in a few decades than had been previously acquired from ancient times to the middle of the nineteenth century. The exploration of the land was begun with great promise under such men as Hutton, Werner, de Saussure, and von Humboldt. Practical considerations led various states to inaugurate surveys, trigonometrical, topographical, and geological, and gradually the appreciation of the scientific value of this work increased.

From the middle of the century on, the interiors of the great continents were explored. Later the discovered lands were divided among Western nations, and some of them are now surveyed. International co-operation in investigations has come, *e.g.* in geodesy, terrestrial magnetism, seismology, meteorology. A vast literature has grown, and a knowledge of results has been spread abroad by academic and popular lectures.

As in olden times, this knowledge has been utilized in three ways, but they are otherwise grouped. Encyclopædic registration stands apart. Near it is general geography, which formerly had not found its true place, but now possesses a definite method and an extraordinary growth of contents. The highest problems of measurement, which formerly had a separate place, are now indissolubly associated with

geophysical problems to form a general science of the Earth which may be contrasted with descriptive or regional geography.

Regional geography at the beginning of the nineteenth century was a mosaic. Karl Ritter improved it in two ways, by methodical use of sources, and by the philosophical handling thereof, ever seeking the causal connection between Earth and man. He built up no school.

Division of labour was necessary for progress. Specialization took two directions, (*a*) studying a strictly limited area, or (*b*) limited phenomena universally. In chorology a new spirit of higher scientific treatment of the contents of any part of the Earth's surface has arisen.

IV.

General geography has also been subdivided. The major divisions are cosmic geography, which has as subject the Earth as a whole, and the science of the surface of the Earth, which investigates its crust and outer spaces.

The problems of cosmic geography have become so varied that further subdivision is necessary. One branch is geophysics, which cannot be considered apart from cosmic physics, for it is necessary to take heavenly bodies into account in discussing internal heat, mean density, surface gravity, terrestrial magnetism, deformation, and each of these problems has its bearings on both physical geography and geology. It is only necessary to mention such phenomena as volcanoes and hot springs, earthquakes, modifications of sea and atmosphere, the deformation of the Earth in the past, and subsequent alterations in the sea. The scientific consideration of most of these problems was begun, or at least took a definite form during some period of the nineteenth century. Another branch is the measurement of the shape and size of the Earth. Although the principle involved in calculating the size of the Earth was known to Eratosthenes, yet the discovery of the polar flattening fundamentally altered the problem. The most refined methods must be adopted to discover the deviation of the Earth from its spherical shape, and the still smaller regional variations from the normal spheroid. This leads to problems of variations in gravity. The simplification of the pendulum has given an impulse to this study, and has resulted in the discovery of unexpected connections between the inner structure of the Earth's crust, and the trend of magnetic lines, and, later, to newer problems, such as the movement of the poles.

Trigonometrical measurements are the basis of large-scale maps. Not merely are there better representations of the curved surface on the map, but the topographical maps are made the basis for the representation of relief and other conditions. Nearly two hundred years separate the attempt of the Italian Borri (1632) to draw magnetic lines from Humboldt's isotherms (1817). In the interval Kircher (1665) drew the first map of ocean currents, Halley (1701) produced a better map of magnetic lines of deviation, and Zimmermann (1780) attempted to make a world map of animal distribution. At Humboldt's instigation, the so-called Physical Atlas of Berghaus appeared in 1840. It was an epoch-making work, and led to wider use of the same methods.

Cosmic geography really pursues a deductive course, as it progresses from observations on the exterior of our planet to questions about its inner construction and internal forces. Observations leading to inductive methods deal with the solid crust, the ocean, and the atmosphere. To these may be added a fourth—the constantly varying water, rising from the ocean as vapour and passing through various stages on its cycle back to it, to do which it plays both an active and a passive *rôle* in the atmosphere, as moving ice or running water alters the solid surface, and in this way is a factor of the highest importance in its outer transformation. Without the water-cycle it would be possible to treat the other three elements separately.

By and through it they are bound in a great dissoluble unity which forms the basis of the general science of the Earth's surface, and so is to be distinguished from the science of the Earth's body. Both together form general geography or the science of the Earth.

The method of investigation is different for each of these elements. The land surface presents changing forms in changing relations from place to place, and also changes in time. Atmosphere and ocean resemble each other in filling of space, material composition, physical condition, and in local and spacial modifications of conditions and mass through motion. The methods of observation differ in that they proceed from the ground upwards in the case of the atmosphere, and from the surface downwards in the case of the ocean. In the latter, the form of the hollow filled by it, and other considerations, among which is the geomorphological *rôle* of organic life, must be considered. Solar radiations are the chief source of energy modifying substances and causing changes of condition and motion in both elements. It acts from the ground in the atmosphere, from the surface in the ocean. Solar energy is the source of the driving power in the water-circulation. Here the scope of observation is very great, as it touches those which concern the other three elements in many points.

Uncoordinated facts about the surface of the Earth have existed since the earliest times. Aristotle attempted to set them in order. Varenius formed logically derived categories. Slowly the methodical questioning of nature was developed, and led to further divisions within the field of study. The sciences of meteorology and oceanology, hydrodynamics and geology, arose. After their separation there remained to the science of the Earth's surface an extensive field of investigation based on the results of geophysics, geodesy, geology, meteorology and hydrodynamics, which considered the surface of the Earth and the phenomena of the atmosphere, ocean and water-cycle bound together with it, as a unity, and strove to interpret their causal connection on the lines laid down by Humboldt. This to-day is the field of labour of physical geography. Its efforts culminate in geomorphology, *i.e.* in the genetic knowledge of the forms of the Earth, arranged according to categories as well as localities, and the nature of their grouping in terrestrial space. This is based on a knowledge of the composition and structure of the land-form and the genesis of its formation through terrestrial forces, and strives through an investigation of chemical and mechanical activity which is continually going on through the action of external forces to trace the course of the evolution of its present form. Physical geography endeavours to become a science of the theatre of organic life and of human existence.

Physical geography and geology differ in their foundations. Both require physics and chemistry, but geology is based more on mineralogy and palæontology, physical geography on meteorology and hydrodynamics. It is not necessary to draw sharp divisions. The geographer cannot do without the rudiments of geology, and the geologist, in order to understand the past, must make use of the physical geography of the present. Whatever boundaries are chosen, there will remain a broad region common to both sciences. This approach of a subject from two different standpoints has had valuable results, *e.g.* in glaciology the close relations of the two subjects have often been shown. Distinguished geologists like Murchison or Hochstetter turned their interests in later life to geography, while others have been able to work harmoniously in both subjects, *e.g.* Suess.

In addition to the widening of the horizon, and the impetus given by Humboldt, physical geography has been stimulated by many other forces in the nineteenth century, many of which have also affected geology, *e.g.* the discovery of the former glaciation of much of Europe, Darwin's theory of coral reefs, the relations of

winds to the baric gradient, the exploration of the ocean, the study of mountain-building in the United States, the Alps, Scotland, and Scandinavia, the genetic point of view adopted in all branches of science.

Another stimulus to advance has been the governmental support of universities, especially in Germany. The value of this is not merely a function of the formation of laboratories and institutes, but is bound up with the freedom of teaching and learning. The professor is expected not merely to teach, but to increase the knowledge of his subject by research and the direction of research. Only through scientific study of the ground on which man is placed and the environments in which he lives can a foundation be prepared for the methodical development of anthropogeography. Anthropology and ethnology, also following scientific methods, come to meet it and give rise to many problems, such as the correlation of settlement, communications, productions and trade with the natural conditions studied by the geographer. The foundation of geographical chairs in technical and commercial universities will bring forth good fruit in the study of such problems.

ON A FLAT MODEL WHICH SOLVES PROBLEMS IN THE USE OF THE GLOBES.*

By Prof. J. D. EVERETT, F.R.S.

THE perusal of a pamphlet by Major Close, describing the system to be adopted in making a new map of the British Isles to a scale of one-millionth, has called my attention to the very great accuracy with which a region covering 10° or 11° in latitude, and a much greater distance in longitude, can be represented in the flat by a judicious use of conical projection. The errors, both as regards area and distortion, are so small as to be imperceptible to the unaided eye, and are much smaller than the inevitable errors introduced by the stretching and shrinking of the paper in printing a map.

Adopting a plan identical in its main features with that employed by Major Close, but simpler for calculation, I have computed the data for a complete series of maps of the world in 10° zones, and the result is embodied in the model which I now exhibit. This consists of eighteen pieces of thin pearwood, each representing a region extending 10° in latitude and 80° in longitude. The scale is the same as that of a 20-inch globe, or about one in twenty-five millions. Nine of the pieces are duplicates of the other nine.

The piece for lat. 0° to 10° is nearly straight, and its length along the edge that corresponds to 0° is equal to 80° of the equator on a 20-inch globe. Of the eight succeeding strips, taken in order from equator to pole, each is shorter and more curved than its predecessor, till we come to the piece next the pole, which is a sector of a circle whose centre is the pole. The other eight pieces may be described as segments of flat rings, all having the same breadth. The two arcs of circles which bound each piece are concentric, so that the breadth of the piece is the difference of their radii—a difference which is the same for all, namely, about $1\frac{3}{4}$ inch, this being the length of 10° of a great circle on the globe. The concave side is in every case turned towards the nearest pole, and the convex side to the equator. The ends of each piece are meridians, and all meridians are at right angles to the circular arcs, which represent parallels of latitude.

Every tenth meridian is made conspicuous, to facilitate rapid counting of 10° intervals in longitude. Actual counting is more convenient for my purposes than

* Meeting of the Research Committee of the Society, November 16, 1903.

marking the divisions with numbers. The 10° spaces in longitude are subdivided into 2° spaces, marked by dots at both edges of the piece and faint lines ruled across. Subdivision of the 10° widths of the pieces north and south is effected, not by permanent marks, but by the application of a graduated strip of card, which answers to the quadrant of altitude of a globe, and can be used for measuring distances in any direction. It is divided to single degrees of a great circle of the globe.

Each piece, if it were flexible like paper, could be made to fit with practical exactness on the belt of the globe which it represents; and two consecutive pieces, say one extending from lat. 30° to 40°, and the other from 40° to 50°, would fit together at the parallel of 40°, which is their common boundary, so long as they lie on the globe. When flattened out, as in the model, the edges which fitted together on the globe would still retain their equality of length, but would have unequal curvatures. Two consecutive pieces of the model have, accordingly, different curvatures at the edges which represent their common boundary. Theoretically they can touch each other only in a point, but their difference of curvature is so slight that to the eye they appear to be in contact over a length of half an inch or an inch. When they are placed in contact and rolled one against the other, it is seen that their divisions exactly tally. If we begin with contact at one end, and roll without sliding till we come to the other end, each meridian marked on the one becomes in turn a continuation of a meridian marked on the other. A meridian can thus be exhibited as a straight line running across the whole eighteen pieces from pole to pole, the points of true contact between consecutive pieces being all on this line. When the pieces are thus arranged, a strip of country some 8° or 10° of longitude in width, extending from pole to pole, is correctly represented; that is to say, all areas in it are on the same scale as on the globe, and all small areas in it are similar to those which they represent.

Fig. 1, which is reproduced from *Nature*, July 30, 1903, shows the general appearance of one set of nine pieces, arranged in order from equator to pole.

If, instead of making the points of contact lie on a meridian, we make them lie on any other straight line, this straight line represents a great circle on the globe, and the region lying within a few degrees of it is correctly represented. The same remark applies to any track laid down on the pieces and passing through their points of contact; its length is the same measured on the pieces as measured on the globe; and, in comparing different tracks from one place to another, the track that is shortest on the model is shortest on the globe. The model thus affords a ready means of tracing the great circle course from one place to another; it is simply the one course that can be represented by a straight line passing continuously along the pieces without jumping over any air-gaps. The graduated measuring-card, which is 95° long, serves the double purpose of indicating the straight line and measuring its length, expressed in great-circle degrees. The angle between the track and the meridian, at either end, is obvious to the eye, and can be measured with a protractor. The variations of this angle, as we travel along the track, are very conspicuous.

In the above description, I have supposed nine of the pieces to represent zones of the northern hemisphere, and the other nine (which are precisely similar to them) zones of the southern. But there is nothing to prevent our using both sets for the same hemisphere, thus extending our operations to 160° of longitude. And we can go still further by adopting an echelon arrangement, in which each piece projects 10° or some multiple of 10° beyond its neighbour. We can thus start from any point in any direction, and travel along a great circle till we return to the point from which we started, the same piece being made to do duty more than once. Two measuring-cards, each 95° long, will suffice; and we can measure the

distance as we go, till the 360° have been completed. But there is little interest in going beyond the 180° which bring us to the antipodal point; as the remaining half of the journey will take us a second time through the same experiences. A few experiments made in this way impress the operator with the fact that every great circle consists of four quadrants, each having one end on the equator, and touching a parallel of latitude at the other end; the angle made with a meridian gradually increasing, from a minimum at the equator, to a right angle at the point of highest latitude.

As the total area of the eighteen pieces only represents two-ninths of the surface of the globe, it is not possible to trace upon them a complete map of the world. It is, however, easy to represent, either in a temporary or a permanent way, the positions of a number of important places in a large region, such as Europe and

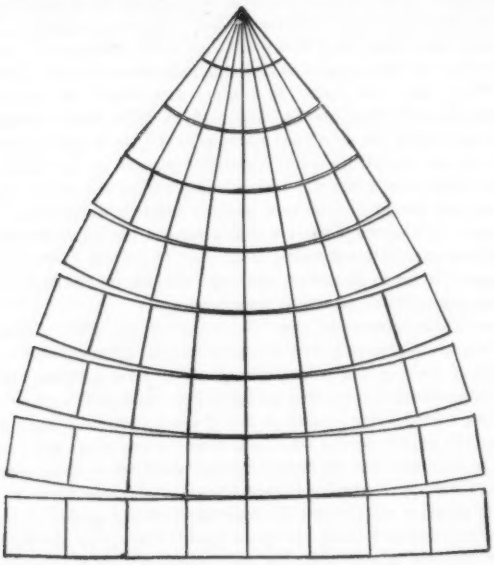


FIG 1.

Asia combined, by fixing gummed labels in the proper relative positions, and writing on them the first two or three letters of the names of the places. The labels can be washed off and new ones employed when it is desired to study a different portion of the globe, or different colours can be employed to distinguish different sets of labels which are not to be used simultaneously. One interesting group includes London, Gibraltar, Malta, Cairo, Aden, Bombay, Calcutta, Singapore, Hong Kong, Shanghai, Pekin, Yokohama, Irkutsk, and St. Petersburg; and the great-circle route between any two of these places can be exhibited as a straight line whose length can be directly measured. Nothing except a globe can so clearly indicate the relative positions of this group of widely distant places. Of course, the whole region cannot be accurately shown simultaneously, as on a globe; but the adjustment can be gradually altered so as to make it always exact at the part under examination, and this part may extend all the way from London to Pekin

or Yokohama. As compared with a 20-inch globe, the representation in the model, though on the same scale, is very much more compact and portable. It would be easy to graduate the backs of the pieces, as well as the fronts, and thus double the extent of country available for labels.

The model can be used to show the position of the sun as seen at a given place at a given time. It is merely necessary to identify the sun with the place over which he is vertical. The latitude of this place is equal to the sun's declination on the day in question, and its longitude (or difference of longitude from the given place) is the sun's hour-angle. This place having been marked by a label, we lay

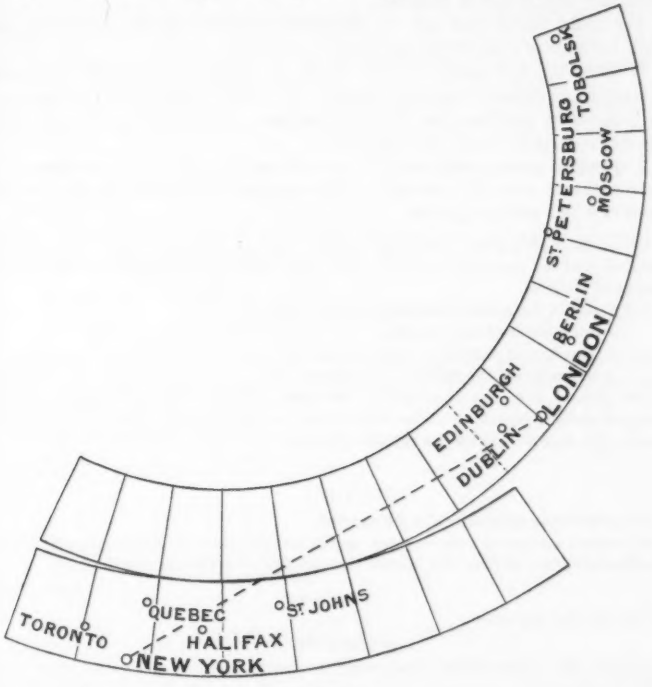


FIG. 2.

the edge of the card scale from it to the given place. The position of the edge gives the sun's azimuth, and shows the direction in which a shadow will be thrown. The distance read off on the scale is the sun's zenith distance.

To determine the sun's azimuth and hour-angle at rising or setting, we find, on the parallel of latitude over which the sun moves, a point 90° distant from the observer's station, as measured with the scale. The direction of the scale indicates the azimuth, and the difference of longitude (found by counting meridians) is the hour-angle.

Fig. 2 shows three of the pieces as set for finding the great-circle track from London to New York. It is represented by a dotted straight line. The positions of Toronto, Quebec, Halifax, St. John's, Edinburgh, Dublin, Berlin, St. Petersburg,

Moscow, and Tobolsk are also marked. The meridians indicated are 10° apart. The dotted one is the junction of two of the pieces.

This is an example of the general problem to find one angle of a spherical triangle when the three sides are given. The two sides containing the angle are to be taken as distances from one of the Earth's poles, and the side opposite to the angle is to be represented by the card scale. To facilitate the counting of the intervening meridians, the 10° intervals should, with the exception of one discrepancy, be kept opposite to each other on pieces which touch. Then, after counting the complete 10° intervals, the additional degrees at the place of discrepancy should receive attention.

The model has obvious uses for educational purposes, and is capable of giving results sufficiently accurate for purposes of navigation.

It serves also to illustrate the advantage of employing true conical projection for mapping an extensive region in sheets. The sheets should not be rectangular, but bounded by meridians and circles of latitude. If they cover 10° in latitude, they might cover 20° or 30° in longitude.

I append a precise specification of the scheme from the point of view of the mathematician, with the necessary demonstrations, including proofs of some theorems which seem to be new.

By a *conical* projection I mean one which could be wrapped round a cone in such a manner that the meridians coincide with generators, and the parallels with circular sections of the cone.

Let θ denote the semi-vertical angle of the cone,

ϕ the latitude of any parallel,

ρ its radius of curvature in the projection,

a the radius of the sphere to be represented.

The parallel is a circular section of the cone, and ρ is its distance from the vertex measured along a generator. The circular section has a radius $\rho \sin\theta$, and represents a circle of radius $a\cos\phi$ on the sphere. Hence—

$$\frac{\rho \sin\theta}{a\cos\phi}$$

is the ratio of representation along a parallel.

In *conical projection with rectified meridians*, the ratio of representation along a meridian is unity; so that, if ρ_0 denote the value of ρ for the equator, we have—

$$\rho_0 - \rho = a\phi,$$

and for any two latitudes—

$$\rho_1 - \rho_2 = a(\phi_2 - \phi_1).$$

If we make the representation exact along the two parallels ϕ_1 and ϕ_2, we have—

$$\frac{\rho_1 \sin\theta}{a\cos\phi_1} = 1 = \frac{\rho_2 \sin\theta}{a\cos\phi_2};$$

$$\sin\theta = \frac{a\cos\phi_1}{\rho_1} = \frac{a\cos\phi_2}{\rho_2} = \frac{a(\cos\phi_1 - \cos\phi_2)}{\rho_1 - \rho_2} = \frac{\cos\phi_1 - \cos\phi_2}{\phi_2 - \phi_1}.$$

It is thus possible so to choose our cone as to make the representation exact at two parallels selected at pleasure. The value above obtained for $\sin\theta$ can be reduced to—

$$\sin\theta = \frac{\sin\frac{1}{2}(\phi_2 - \phi_1)}{\frac{1}{2}(\phi_2 - \phi_1)} \sin\tfrac{1}{2}(\phi_1 + \phi_2),$$

showing that θ is rather less than the middle latitude $\frac{1}{2}(\phi_1 + \phi_2)$. Again, we have—

$$\frac{\rho_1}{\cos\phi_1} = \frac{\rho_2}{\cos\phi_2} = \frac{\rho_0 - a\phi_1}{\cos\phi_1} = \frac{\rho_0 - a\phi_2}{\cos\phi_2},$$

$$\text{whence } \rho_0 = a\,\frac{\phi_2\cos\phi_1 - \phi_1\cos\phi_2}{\cos\phi_1 - \cos\phi_2}.$$

The ratio of representation along any parallel other than the two selected is—

$$\frac{\rho \sin\theta}{a\cos\phi} = \frac{\rho_0 - a\phi}{a} \cdot \frac{\sin\theta}{\cos\phi} = \left(\frac{\phi_2\cos\phi_1 - \phi_1\cos\phi_2}{\cos\phi_1 - \cos\phi_2} - \phi\right) \cdot \frac{\sin\theta}{\cos\phi}$$

$$= \frac{(\phi_2 - \phi)\cos\phi_1 + (\phi - \phi_1)\cos\phi_2}{\cos\phi_1 - \cos\phi_2} \cdot \frac{\cos\phi_1 - \cos\phi_2}{\phi_2 - \phi_1} \cdot \frac{1}{\cos\phi}$$

$$= \frac{(\phi_2 - \phi)\cos\phi_1 + (\phi - \phi_1)\cos\phi_2}{\phi_2 - \phi_1} \cdot \frac{1}{\cos\phi}.$$

The factor by which $\frac{1}{\cos\phi}$ is here multiplied may be recognized by the mathematician as the calculated value of cos ϕ obtained by linear interpolation from the values of cos ϕ_1 and cos ϕ_2. When the Earth is treated as a sphere, *the ratio of representation along a parallel is the ratio of the interpolated to the true value of the cosine of the latitude.* This fact does not appear to have been previously noticed.

If we plot the curve in which ϕ is abscissa and cos ϕ ordinate, the interpolated value is the ordinate drawn to the chord joining the two points ϕ_1, ϕ_2 of the curve, and is less than the ordinate of the curve. On the other hand, the extrapolated value of ϕ for a point beyond ϕ_1 or ϕ_2 is the ordinate of a point in the chord produced, and is greater than the ordinate of the curve.

The minimum ratio of the interpolated to the actual value of cos ϕ occurs near the middle latitude, and, on account of the slow change near a minimum, is practically identical with the ratio at the middle; that is, with—

$$\frac{\frac{1}{2}(\cos\phi_1 + \cos\phi_2)}{\cos\frac{1}{2}(\phi_1 + \phi_2)}, \text{ or } \cos\tfrac{1}{2}(\phi_2 - \phi_1).$$

In my system this is cos 5°, or 1−0·0038. The maximum error, when the two bounding parallels of each 10° zone are of the exact length, is therefore less than four parts in a thousand.

The exact position of maximum error can be found by differentiating $\frac{\rho_0 - a\phi}{\cos\phi}$, and is given by the equation—

$$\phi + \cot\phi = \frac{\rho_0}{a}.$$

At middle latitude the constant quantity $\frac{\rho_0}{a}$ is rather less than $\phi + \cot\phi$, for it is easy to show that—

$$\frac{\rho}{a} - \tfrac{1}{2}(\phi_1 + \phi_2) = \frac{\frac{1}{2}(\phi_2 - \phi_1)}{\tan\frac{1}{2}(\phi_2 - \phi_1)} \cot\tfrac{1}{2}(\phi_1 + \phi_2).$$

$\phi + \cot\phi$ changes in the opposite direction to ϕ; hence, as $\phi + \cot\phi$ is less for maximum error than for middle latitude, ϕ is greater for maximum error than for middle latitude.

The condition of maximum error above stated can be put in the form—

$$\cot\phi = \frac{\rho}{a},$$

indicating that the cone is the tangent cone to the sphere at the latitude of maximum error.

Writing cot ϕ for $\frac{\rho}{a}$ in the general formula $\frac{\rho}{a} \cdot \frac{\sin\theta}{\cos\phi}$ for ratio of representation, we obtain—

$$\frac{\sin\theta}{\sin\phi}$$

as an expression for the minimum representation. θ is less and ϕ greater than the middle latitude.

The case of $\phi_2 = \frac{\pi}{2}$ is exceptional. The formula for the ratio of representation becomes—

$$\frac{\left(\frac{\pi}{2} - \phi\right)\cos\phi_1}{\left(\frac{\pi}{2} - \phi_1\right)\cos\phi} \text{ or } \frac{\frac{\pi}{2} - \phi}{\sin\left(\frac{\pi}{2} - \phi\right)} \cdot \frac{\cos\phi_1}{\frac{\pi}{2} - \phi_1},$$

which attains its least value $\frac{\cos\phi_1}{\frac{\pi}{2} - \phi_1}$ when $\phi = \frac{\pi}{2}$. For the 10° zone extending from lat. 80° to the pole, this least value is $\frac{18}{\pi}\cos 80° = 0{\cdot}99493 = 1 - 0{\cdot}00507$, and is attained at the pole. This error of $-0{\cdot}00507$ is larger than the maximum error for any other part of the globe; but as it only applies to parallels very near the pole, it is immaterial. At 2° from the pole the error is $-0{\cdot}00487$, and at 5° from the pole $-0{\cdot}0038$.

Leaving out of account the small region within 5° of the pole, the error of representation along a parallel is always less than four parts in a thousand. Along meridians there is no error.

Thus far we have assumed that the bounding parallels of each zone are of the correct length. The errors of representation, as the above discussion shows, are then always negative. The representation will be improved by multiplying the ratios of representation along parallels by the constant factor which makes the average representation along parallels correct; in other words, which makes the area of each 10° zone correct. This factor can be directly deduced from the consideration that the error committed is virtually the employment of the ordinate of the chord of the curve $y = \cos\phi$, instead of the ordinate of the curve itself. The correcting factor will be the ratio of the area under the curve to the area under the chord. The area under the curve (found by integrating $\cos\phi\, d\phi$ from ϕ_1 to ϕ_2) is $\sin\phi_2 - \sin\phi_1$. The area under the chord is $\frac{1}{2}(\cos\phi_1 + \cos\phi_2)(\phi_2 - \phi_1)$. The ratio of the former to the latter reduces to

$$\frac{\tan\frac{1}{2}(\phi_2 - \phi_1)}{\frac{1}{2}(\phi_2 - \phi_1)} = \frac{36\tan 5°}{\pi} = 1{\cdot}002546,$$

which is the required correcting factor.

After the application of this constant multiplier, the ratio of representation will be—

$1 - 0{\cdot}00127$ at the middle latitude of each zone,

$1 - 0{\cdot}00252$ indefinitely near the poles,

$1 + 0{\cdot}00255$ at the bounding parallels of the zones.

These will be the largest departures from unity, and the positive and negative errors will be so balanced as to make the area of each zone correct.

In constructing the model, the multiplier $1{\cdot}0025$ or $1 + \frac{1}{400}$ was employed, and only two decimals were retained in the results.

The following are the numerical data for the nine zones, as represented in duplicate by the eighteen pieces:—

DATA FOR THE NINE ZONES.

Zone.	Sin θ	θ	Lat. for smallest ratio.	Smallest ratio uncorrected.
° °		° ′	° ′	
0 to 10	0·087044	5 0	5 1	1 − 0·00381
10 to 20	0·25849	14 59	15 2	1 − 0·00381
20 to 30	0·42208	24 58	25 4	1 − 0·00381
30 to 40	0·57285	34 57	35 6	1 − 0·00381
40 to 50	0·70621	44 56	45 9	1 − 0·00381
50 to 60	0·81811	54 54	55 12	1 − 0·00381
60 to 70	0·90516	64 51	65 19	1 − 0·00381
70 to 80	0·96470	74 44	75 34	1 − 0·00384
80 to 90	0·99493	84 14	89 59	1 − 0·00507

	Radii of curvature of		Arc of 10° at edges	
	Convex edges.	Concave edges.	Uncorrected.	Corrected by multiplier.
°				
0	114·883	—	1·7453	1·7497
10	38·098	113·138	1·7188	1·7231
20	22·263	36·353	1·6400	1·6441
30	15·118	20·518	1·5115	1·5153
40	10·847	13·373	1·3370	1·3403
50	7·857	9·102	1·1219	1·1247
60	5·524	6·112	0·8727	0·8749
70	3·545	3·779	0·5970	0·5985
80	1·745	1·800	0·3031	0·3039
90		0	0	0

The difference between the two radii of curvature of each piece is 1·745, and this is the width of the piece.

After Prof. Everett's account of his model, the following discussion took place:—

Major CLOSE: I should like to say that it was quite a surprise to me that the scale areas came out the same to the north and south of the zones. The projection Colonel Clarke suggested was one in which the areas of the zones were made correct. The meridians were true to scale, and in each zone the scale areas north and south were equal, and it was quite a surprise that this was the same all over the globe. I think it is likely to prove very useful. It is a thing we are sure to hear more of in the future.

Mr. E. G. RAVENSTEIN: I have nothing to say, except that for educational purposes in classes it strikes me the presentation of the globe to the pupils would be preferable to these explanations, so far as the pupils are concerned.

Mr. E. A. REEVES: I think there are occasions when this projection would be useful, though generally I should prefer to use a globe or Prof. Reclus' curved maps which he was explaining to us some time ago. Its great advantage, I take it, is that it is very portable. But still for ordinary purposes I should say that wherever a globe is available it is far better to use it for instruction. However, I think this projection might at times be useful, as Prof. Everett has said, in laying down great circle distances between different points.

Mr. G. J. MORRISON: No one can suppose for a moment that anything of this sort can take the place of a globe in teaching. Even in the teaching of old students, who are learning surveying and other things, there are a great many things which can be very much better taught on a globe, if a globe is available. But a globe is not portable, and this model of Prof. Everett's is extremely portable, and it enables you to solve a great many questions of different sorts. Now, I admit at once that if you stick to any one point you might get something better than that. I don't think a universal instrument, an instrument that will do almost everything, is ever as good for any particular purpose as a special instrument. If you want to lay down a great circle course either at sea or on land, a map on gnomonic projection, in spite of the distortion, is no doubt very much better than that. But there are many people who are not constantly sailing who at one time want to lay down a great circle, at another time to find an azimuth, and at another time to work out a problem in spherical trigonometry, and, as

Prof. Everett has now told you, he can do all those things and many more with that model. And the more you look at it the more you will see that it is extremely ingenious, and in the hands of an expert I think it will be extremely useful. As an educational model, particularly for young people, I don't think it is very good.

Dr. DOWNING: I should like to add one word as to the mathematical part of the discussion. I have read the paper with great interest, and the way in which Prof. Everett brings out the errors which affect different parts of the sphere in this projection is very clear, and one point which I have not seen before in one of his expressions is very neat and very interesting to any one who has had a mathematical training, and who is occupied in these matters.

In reply to a question from the Chairman, Prof. EVERETT said: I think the best way to use it for teaching purposes would be to put it into the pupil's hands and set him to work to solve problems on the globes. It is much handier to put into the hands of boys than a big globe, which is easily scratched. It should be used on a flat table. If the pieces were made of paper, the teacher could set up the solution of a problem and pin it to a board for exhibition to a class. I wish to remark that the mathematical proofs here given do not start from technical formulæ, but from principles familiar to ordinary mathematicians.

REVIEWS.

EUROPE.

CENTRAL EUROPE.

'Central Europe.' By Joseph Partsch, PH.D., Professor of Geography in the University of Breslau (one of the volumes of the Regions of the World series edited by H. J. Mackinder, M.A.).

IT is to be hoped that readers will not be deterred by the character of most of the earlier chapters of this volume from reading it to the end. There is, it must be avowed, in the first part of the work a good deal of heavy reading, composed of a succession of details which it would be rash to say no man can grasp, but in which it is difficult to detect any sequence, any leading ideas serving to arrange the numerous facts in due subordination and co-ordination, and thus to fix them in the memory. This seems to arise in a large measure from the nature of the subject.

A frontispiece map sets before us what the author and editor mean by Central Europe. It is a region stretching from the Black sea and the Adriatic to the North sea and the Baltic, but conterminous with a group of political units. It comprises Bulgaria, Roumania, Servia, Montenegro, Austria-Hungary with its annexes of Bosnia and Herzegovina, Germany, Switzerland, the Grand-duchy of Luxemburg, the Netherlands, and Belgium. One cannot help wondering why such an aggregate should have been selected to form a single region. If the suggestion of the group was due to the author, one is inclined to suspect that his residence on the borders of the eastern colossus is the origin of the idea that gives unity to this volume. The dread of Russia seems to have made it natural to him to place in one group all the states immediately threatened by that power. It is

only on strategic grounds that we can find in the volume itself any serious attempt at justification for the unity assigned to the group of states above enumerated. In the opening chapter that unity is asserted, but not demonstrated, although the strategic reasons for considering it as a whole are there hinted at in a sentence which, to say the least, will take the English reader by surprise. That Russia is alone thought of as justifying the dividing line of the region on the east is shown by the unconvincing nature of the consideration brought forward on p. 321, as marking "the sharpness with which the border-line on the east of Central Europe divides one civilization from another," the consideration, namely, that, while "even the highest and most difficult mountains of Central Europe have railways running through them," railways even in fertile parts of Russia contiguous to Central Europe are few and far apart. Still more plainly is the dominance of the conception of Russia as forming the great line of cleavage revealed on the last page but one of the book, near the close of the very interesting and instructive chapter on the Conditions of National Defence. It is there expressly contended that "a general view of the defensive measures of Central Europe in the present day brings out, as at no previous time, the essential unity of this great civilized region;" and the author follows up that contention by laying special stress on the importance of the alliance of the two great Central European powers, adding that if these two continue to hold together, their smaller western neighbours will also "be enabled, under the protection of their swords, still to enjoy prosperity and security." True, we have elsewhere, in the sentence already alluded to, a reference to another possible danger, presumably to those smaller western states in the first instance. On p. 4 we are told that it is not to be supposed "that the colossal empires of Great Britain and Russia . . . are destined gradually to subjugate or absolutely to absorb the less spacious powers of Central Europe;" but this reference to the empire of Great Britain must have been introduced merely to round off the conception of Central Europe with formal completeness. That Russia may desire to extend her domain at the expense of Central Europe is indeed a possibility, however lamentable; but surely the suggestion that "the empire of Great Britain" should ever desire to extend its land frontier on any part of the mainland of Europe is merely fantastic. That empire has already one great land frontier which is the cause of grievous anxiety, another which is the cause of none. On the mainland of Europe the empire was fortunately deprived in advance of one land frontier in 1558. What remains is quite enough.

But whatever may have been the reason for treating as one the long array of diverse states, large and small, dealt with in this volume, the result appears to be a lack of that breadth of treatment which is necessary to give unity of interest to the subject. Instead of this, we have a sectional treatment, and that twice over; first, with special reference to the physical conditions, and next, with special reference to the human aspects of the geography of the region. Both parts of the book show great wealth of knowledge and keenness of insight; but the first part will probably come to be regarded as rather for reference than for reading, whereas the latter half of the book may be strongly recommended for the sustained interest with which it carries the reader on from section to section. History and geography are here made to throw light on one another. The influence of geographical conditions in various circumstances is brought into relief by what J. S. Mill called the method of concomitant variations, the operation of such influences being shown chiefly through the effect they have had on the fortunes of the chief towns.

One minor point may be referred to. The Roman alphabet is used in the languages of most of the states embraced by this volume, but used in a variety of

ways, and mostly with the addition of diacritic marks. This creates inevitable difficulty in the spelling of proper names, and it seems at present to be practically impossible to find any consistent solution for that difficulty. In this volume, many of the names belonging to the less familiar languages are spelt phonetically, but this is far from being a uniform rule. On p. 48 (and elsewhere) we have the spelling Marosh. If so, why not Buchech instead of Bucsecs in the second line below? On p. 235 we have Raduyevats. If so, why not Galats on p. 238 and elsewhere? And so in numberless other instances. These examples are not given in the spirit of petty criticism. As regards this matter, the present reviewer lives in too big a glass house to wish to throw stones, and his only desire is to show how much it is to be wished that geographers should come to some agreement on this question.

The volume is provided with an index, and is amply illustrated with maps and diagrams, all well conceived. Five of the maps, orographical (or bathy-hypsometrical), geological, and ethnographical, are coloured. They are all by Bartholomew of Edinburgh, and show the same excellent work as those in the first-published volume of this series.

G. G. C.

ASIA.

KANGCHENJUNGA.*

'Round Kangchenjunga.' By Douglas W. Freshfield. London: Edward Arnold. 1903.

No part of the world of mountains requires more attention from physically well-trained scientists than does the region of the farther Himalayas. In the nearer Himalayas overlooking the plains of India are many well-known "hill stations," beyond which the great majority of visitors never move. But there is always a minority who forsake society to search amongst the valleys of the sub-Himalaya for scenery or sport. To them the conformation of ridge and vale, the curving course of the mountain torrents, and the uneven tracks of the mountaineer are well enough known within such limits as a summer's holiday will permit them to wander. But they seldom penetrate far enough to make a serious geographical study of Himalayan structure, or to examine Himalayan glaciers with the critical eye of an Alpine expert. There is, indeed, a professional element to be noted, which belongs to the Indian Survey—men who go far and see much; but they are not men who write about what they see, and the limit of their sphere of observation is fixed by the financial issues which govern the Survey budget. Breaking records in ascending peaks, or assisting science by examining the conditions of glacial action in remote altitudes, is not encouraged by the Indian Government, for the simple reason that it does not pay. Thus it happens that beyond Kashmir, or the districts of Kumaon, Garwhal, and Sikkim, there is nothing of the nature of a detailed survey existing; and even in Kashmir and Sikkim such surveying is limited to the immediate neighbourhood of British occupation. Of the topographical detail of the further ranges of the Central Himalayas, in Nepal, we know nothing whatever; and can learn nothing, so long as the present system of exclusion is applied to European travellers. In short, the greater part of the Himalayas still forms a *terra incognita*; but whilst actual topographical detail is wanting in our

* Mr. Freshfield requests us to note the following *Corrigenda*: P. 25, line 4 from top, *for* 1892 *read* 1902; p. 178, line 18 from bottom, *for* Thangchen *read* Ram Thang; p. 354, *for* March, 1893, *read* 1903; p. 360, *for* Sikhim Expedition of 1868 *read* 1888.

maps, there are, nevertheless, countless peaks in the snow-capped mountain chains of which the positions are fixed with mathematical certainty by the process of triangulation from a distance. It has been found possible, too, in the interests of a general structural outline of the mountain, to trace the connection of these peaks, and to indicate the general position of many mountain ranges, and consequently of the valleys separating them; and it is only minor details that are required to fill up blank spaces or to replace conjecture. It is therefore an immense assistance to the geographical illustration of the structure of Himalayas when mountaineers of Alpine experience like Mr. Douglas Freshfield gave their time and their ability (to say nothing of their money) towards unravelling the mysteries of those far-off mountain fastnesses which the foot of the professional surveyor is never likely to tread. Mr. Freshfield moves to his work with all that previous knowledge can give of exact information in his hand. He knows what is determined and what is not; which peaks are certainly fixed in position and altitude, and which are uncertain. Consequently, every scrap of additional information he gives is valuable. With some of his convictions (for instance, he is convinced that Mr. Graham ascended Kabru), he will hardly get professional surveyors to agree. Mr. Graham was totally unable to interpolate his position, and such observations as he made will not fit Kabru; but all that Mr. Freshfield has to say on this, as on any other, subject he touches, is of direct value to those whose business it is to put together all available geographical material for the purpose of producing a general map of the Himalayas. If we only had a few mountaineers of the same sort yearly to venture as far afield, accepting the same risks (which, after all, are not great), and imbued with the same scientific spirit of inquiry as Mr. Freshfield, we should soon be *au fait* with the uttermost Himalayas, so far, at least, as they are not barred from us by native prejudice.

There is just a word to be said about high altitudes. All, or very nearly all, the peaks fixed in position by the Survey Triangulation have their heights recorded. The effect of refraction is of course duly eliminated from the observations, but it may happen that the formula used for the application of this correction may not invariably fit the peculiar atmospheric conditions prevailing at the time of observation. In other words, there may be errors in the recorded altitude still to be eliminated by further observation. But they cannot be large errors, and the recorded heights may safely be used by travellers for the purpose of determining their own attained altitudes by a simple observation of the altitude of some known peak above them, and their distance from it. It may be said that this is not so very simple, but it must be seldom indeed that the opportunity for interpolating position can be entirely wanting during the ascent of a high mountain with other fixed heights around it. At any rate, aneroids are not to be trusted, any more than are hypsometers or mercurial barometers, when very high altitudes are in question. It may be taken as accepted by most professional mountain surveyors that such an altitude as 23,000 feet, for instance, is not determinable by any form of barometer. Mr. Garwood, who accompanied Mr. Freshfield, believes in a Watkins, but he deals with more reasonable altitudes. It would have been more satisfactory, however, to have had the confirmation of an actual observation to a fixed peak or two. Good mountaineers should read Mr. Freshfield's story for themselves. It is well worth it. It is magnificently illustrated—no finer views of the finest of Himalayan snowy altitudes have ever been taken. And Mr. Freshfield's own power of word-painting is yet more illustrative than the direct illustration. Take, for example, his description of that marvellous view of Kangchenjunga from under the flagstaffs on Observatory Hill at Darjiling: "The variety of expression in the vast landscape was extraordinary. At dawn the lower mountains shone, indistinct

in detail, through a veil of amethystine vapour; the damp air converted the naturally green hills of the middle distance into blocks of blue or mauve colour, recalling the background of an old Venetian picture. Soon the sun's shafts, darting into the thousand hollows that lie between the snows and Darjiling, drew the warm, moist air out of their depths in transparent waves. These, as they rose into a colder atmosphere, were condensed and transformed into tall, luminous, sharp-edged columns of cloud which rose vertically, until, caught by some upper current, they bent and broadened at the top, and finally broke up into detached fragments, which floated away slowly northwards to lodge in the hollows of the snows during the hours of noontide heat. Meantime less adventurous cloudlets loitered among the ridges which break down one beyond the other to the lowlands of Kuch Behar, or hung motionless, bright bars throwing pale shadows across the amber patch of plain, visible where the Teesta breaks through a deep gate in the outermost range of foothills." Can any photograph recall the Himalayan cloudland like that? or present to the imagination the glow and the glory of the "almost unbelievable vision" which Mr. Freshfield depicts as the day wears to its close?

T. H. H.

SIBERIA.

'From Paris to New York by Land.' By H. de Windt. London: George Newnes. 1904. Pp. xiii., 311.

This account of a journey from the western sea-board of Europe to the eastern sea-board of North America is mostly occupied with the formidable regions between Irkutsk and Bering straits, the passage of the straits, and the crossing of Alaska. The expedition was undertaken to ascertain—it has pretty well disproved—the feasibility of an Arctic railway uniting the American lines with the Siberian. The writer's sufferings, as recorded by himself, were so severe and prolonged, the task he undertook so beset with natural difficulties, that it is no wonder if a certain dyspepsia has got into his style; if he finds Moscow dull and dreary; if he recognizes so grudgingly the recent progress of Irkutsk; if he dismisses the Greater Schwarzwald of the Urals as "merely downs" (downs which reach 5000 feet); and if, after sounding almost every possible depth of misery among the Chukche villages, he introduces us to the first Eskimo settlement in Alaska as "infinitely drearier and more desolate." At the same time, his picture of the genial *ispravnik* of Verkhoyansk is a pleasant interlude; the agricultural work of the Skoptsi colony just outside Yakutsk is effectively described; and it must be recognized that the author's travels involved experiences as trying as anything that can be attempted in North Asia. His undertaking was of considerable negative importance, if it only discouraged fantastic schemes; it may be hoped that his criticisms of the remote Siberian outposts, such as Sredni Kolymsk, will not fail of result.

Some of the distance figures are not easy to follow. Thus, on the map facing p. 193, the interval between Verkhoyansk and Nijni Kolymsk is given as 2000 miles, while on p. 277, in the "approximate table of distances," it is returned as 1340; again, we have estimates of 3200 and 2840 miles for the space between Verkhoyansk and Bering straits, even the lesser being, we fancy, excessive if a straight course be intended. It is probable, and highly desirable, that the Siberian trunk may soon throw off a branch to Yakutsk, but why should this be prolonged *north* to Gijiga? For though this may be no "idle dream," as Mr. de Windt assures us, it is surely an idle way of describing the connection of two places lying practically in the same latitude, but separated by some thirty degrees of longitude?

Mr. de Windt's narrative shows clearly how recent developments in Southern Siberia have not only not been accompanied by parallel progress in the far North,

but have tended to draw off Russian activities from the Arctic and sub-Arctic belts of the Tsar's Asiatic domain to more temperate and promising zones. The railway has, in fact, sucked up an ever larger share of the life of Greater Russia, and thus the European outposts in the Chukche country have been gradually abandoned, the settlements in the Kolyma, Yana, and Indighirka have declined, and some of the old colonies of the eighteenth century have been wholly abandoned. On the other hand, the upper and middle Lena (down to Yakutsk) and the shores of the Okhotsk sea have distinctly progressed; the gold output in the Lena basin has trebled in the past four years; coal has been recently discovered close to Lake Baikal, and is already being exported in large quantities to the Pacific ports; while in the farthest East a line of steamers now leaves Vladivostok monthly (from June to September) to visit the ports of the *Okhotskii-Kamchatskii Krai*—Petropavlovsk, Okhotsk, Ayan, and Yamsk.

C. R. B.

Formosa.

'Formosa under the Dutch.' By Rev. William Campbell, F.R.G.S., English Presbyterian Mission, Tainan. London: Kegan Paul, Trench, Trübner & Co. 1903.

It might, perhaps, be thought that, with a large monograph on Formosa but just issued from the press, another volume, also of considerable bulk, is superfluous. But while Mr. Davidson's book, which was reviewed in this *Journal* for October, aims at giving all available information upon a large number of subjects—at producing, in short, as complete a monograph of the island as the author could compass, the present volume has but a limited field, and hardly overlaps Mr. Davidson's ground at all, except in dealing with Koksinga's conquest. At the same time it must be said that the book under review has of necessity less interest for the geographer as such than its predecessor, for the larger part of it is devoted to an account of the mission history and the progress of Christianity on the island in earlier days. Its more accurate title would be "Dutch Missions in Formosa in the Seventeenth Century."

The author divides his book into three parts. The first is a "General Description;" the second, which extends to some 300 pages, is composed of documents drawn from various sources, dealing with church work on the island; the third is the detailed account of Koksinga's siege of Fort Zeelandia, translated from the *Verwaarloosde Formosa*, published in 1675. There is also an appendix, giving, amongst other things, Benyowsky's narrative of his Formosan adventures, apparently from Captain Pasfield Oliver's biography. The "General Description" is partly from Valentyn and partly from Candidius's account. It will thus be seen that the volume is almost entirely a compilation, and indeed does not pretend to give any first-hand information except such as is contained in a few pages of explanatory notes and the useful bibliography at the end. It therefore does not demand further notice at our hands, beyond mention of the fact that the second part, culled from documents not always easily accessible, has occasional points of interest apart from that attaching solely to the efforts of the Dutch missionaries. The book shows defective editing, it being in many cases impossible to tell the author of a section unless the preface be read.

F. H. H. G.

AFRICA.

Italian Somaliland.

'Seconda Spedizione Bòttego. Lugh: Emporio commerciale sul Giuba. Memorie e note di Ugo Ferrandi.' Rome: Published by the Italian Geographical Society. 1903.

This is a work of some value, written by the officer left as commandant of the Italian post at Lugh at the time of Bòttego's last expedition through Somaliland. Captain Ferrandi remained in charge some fifteen months, and during this time made the most of his opportunities of collecting information on the country, its inhabitants, and commercial relations, opportunities which rarely offer themselves to a like extent during the constant marching of an exploring expedition. The book does not consist, for the most part, of a personal narrative of the writer's experiences, though the events connected with the foundation and tenure of the post (which had to withstand a formidable attack by the Abyssinians) are related in the second chapter, but the material collected is arranged in the form of a monograph, its value being thereby much enhanced.

The physical aspects of the Lugh district are sketched in the first chapter. As is well known, the place, which has been for some time one of the chief centres of trade for Southern Somaliland, is placed in a strong position on the neck of land formed by a circuitous bend of the Jub (here generally known as the Ganana), a large part of the included space being occupied by native cultivation, though much of the grain that is sold in the market of Lugh comes from the red or black soil regions to the east (cf. *Journal*, xxi. p. 168, where further notes by Captain Ferrandi on the country between Lugh and the coast will be found). The village of Lugh (of the types of houses in which a full description is given) does not differ essentially from other agricultural villages of the Rahanwin, and is smaller in extent than Bardera, though its commercial importance is greater. Captain Ferrandi discusses the question of the navigability of the Jub, which he does not consider likely to prove of much service to the Italians in their efforts to open up the country. He describes the rafts in use by the natives, the various fords in the Lugh district, the rise and fall of the river, the formation of sandbanks and shallows, besides giving much information on the fauna of the surrounding country.

In the third chapter notes are given on the natives of this part of Somaliland (the Rahanwin), who differ essentially from those of the more northern regions. They belong to a group which is sometimes designated as "Sabb," in contradistinction to the pure Somalis, who look down upon them as an inferior race. Among them the Gasar Gudda of Lugh occupy a predominant position, though these are really of very mixed race, and consider themselves distinct from the Sabb or Rahanwin. The manners and customs, beliefs, folk-lore, etc., of the people are fully described, while in the fourth and last chapter Captain Ferrandi enters into particulars respecting the trade routes, means of transport, commercial usages, etc., etc., of the country. Meteorological statistics are given in an appendix. Altogether the book supplies much information on a part of Africa of which our knowledge has hitherto been very imperfect.

South-East Africa.

'Big Game Shooting and Travel in South-East Africa.' By F. R. N. Findlay. London: Unwin. 1903.

The literature on this part of Africa is still so far from abundant that this book may do something to improve our knowledge of its general features, though appealing in the main almost solely to sportsmen. Mr. Findlay's routes in Portuguese

territory traversed the country north of the lower Pungwe river—a swampy and feverish tract, which, in his opinion, is not likely to prove of much economic value. He also visited Zululand and other parts of South Africa. The author professes, no doubt honestly, to have greatly at heart the preservation of South African game from the reckless destruction to which it has been subject in the past, and in the preface he expresses the hope that the book may further the scheme for game reserves in South Africa. But, though he certainly deserves praise for adherence to sporting etiquette in respect of the sex and age of the animals killed, his descriptions and pictures of his "bags" suggest a doubt whether the object in view is best of all promoted by the example of such travellers as himself. Descriptions of the country are to be found here and there, but they require to be searched for amid the personal adventures which make up the bulk of the book. Two articles which have already appeared elsewhere are incorporated into the book. The first of these, by Olive Schreiner, on "Waste Land in Mashonaland," is a protest against the wanton destruction of animal life, which is still too common; the second, by Mr. Cronwright Schreiner, treats of the migrations of the springbuck. The external appearance of the book is greatly spoilt by the objectionable loaded paper used.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Earth Structure.

'The Evolution of Earth Structure.' By E. Mellard Reade, F.G.S. Longmans, Green & Co. 1903. 1 Vol. 8vo, 342 pp. and 40 plates.

Mr. Mellard Reade is well known among investigators of the great problems of terrestrial physics. An engineer and architect, with a wide scientific training, intimately acquainted with all the authorities, even the most recent, skilled in bringing experiment to the service of his deductions, he established his reputation by a work on the Origin of Mountains, to which the Murchison Medal of the Geological Society was awarded in 1896. He now presents a synthesis of his theoretical conceptions in a book wherein he views from a truly lofty standpoint the variations in the structure of the Earth.

Mr. Reade begins by establishing beyond dispute the reality of the regional oscillations which have in turn affected different parts of the Earth's surface, and cannot be explained simply by changes in the relative level of solid land and ocean, inasmuch as they exhibit differential movements and imply a warping of more or less extensive regions. After showing that the principle of "isostasy" is quite insufficient to explain the phenomena observed, he arrives at the conclusion that the cause of changes of level must be looked for in modifications which affect the volumes of the substances composing the Earth without altering their masses.

Mr. Mellard Reade considers that the Earth possesses a high internal temperature, that the greater part of it is kept in a solid condition by pressure, but that this retains the property of becoming fluid whenever, for any cause, pressure is removed. Volcanoes are a demonstration of the incessant reactions which take place in the viscous layers lying between the nucleus and the solid crust. Igneous matter is there subjected to elaboration, producing what has been called "differentiation of the magmas." This phenomenon, as well as those of "recalescence," are necessarily accompanied by changes of volume. In addition, the solid crust, composed of superposed layers, has its equilibrium disturbed by the changes of temperature which it experiences.

To summarize, expansion reveals itself by a rising of the crust, while contraction is followed by subsidence. Hence this conclusion: "The irregularities in the form of the spheroid, which give us our diversified world of land and water, arise

from differences in the specific gravities of sections of the Earth's crust and the underlying matter." The character of these differences being accidental, the variations from the spherical form which they determine can be neither original nor permanent. "Nor are they features that have been growing larger from the dawn of geologic history, such as would be likely to occur from a differential radial shrinking of the Earth."

Nevertheless, structural evolution is not capricious, and the author recognizes that the growth of land-areas on the globe is governed by certain laws of development. He rejects the theory of Prof. Suess, and shows that the *rôle* attributed by his hypothesis to subsidences and to faultings in the production of the varieties of terrestrial relief involves a colossal expenditure of energy quite out of proportion to the phenomenon to be explained.

Mr. Mellard Reade discusses the much-controverted question of the permanence or non-permanence of geographical features. He believes that the observed facts suffice to prove that the continental masses have been subjected at different times to vertical movements of 8000 to 10,000 feet in altitude, which leads him to the conclusion: "In the views I have elaborated there is little to favour the idea that the continents are permanent." He goes still further, and believes the study of the latest soundings in the Atlantic shows that the variations of level in the bed of that ocean are exactly of the same order as those of any continental mass, and he declares that "movements and interchanges of such magnitude have occurred in the distribution of the oceans and land-masses during geologic time that it would be a misnomer to call them permanent."

Here we are inclined to think that the eminent author is speaking rather as architect than as a geologist. If his career had brought him into close relations, not merely with the great problems of terrestrial physics, but also with the details of distribution of the sediments of different ages, and, in particular, if he had been forced to consider the problems of the reconstruction of old shore-lines at different geological periods, we believe that he would have been struck by many characteristics which appear to have escaped him. He seems to have no doubt that the Pacific ocean, which represents more than a third of the surface of the globe, has existed almost within its present contours since Carboniferous times, and that since that distant epoch the shores and successive seas have almost invariably coincided in the east with the actual American coast. Nowhere in his book does he take into account the part played throughout geological time by that internal sea, the Central Mediterranean of Neumayr, the Mésogée of Mr. Douville, which, until the middle of the Tertiary era, continued to sever Eurasia and Indo-Africa, and within whose gradually diminishing domain the great foldings, Caledonian, Hercynian, Pyrænean, and Alpine were concentrated. These are features which may truly be termed permanent, and they impart a clearer unity to terrestrial evolution than Mr. Mellard Reade has perceived.

Finally, it is somewhat astonishing to find that an author who draws such excellent arguments from volcanic action should seem to have no suspicion of the important part played by discharges of gases and vapours in the evolution of the Earth's crust. It is these gases of internal, not external origin, as Prof. Suess has clearly seen, which, discharging by fits and starts, draw with them the melted magma, and cause it to rise along lines of least crustal resistance. These lines have been traced out from the earliest times, and separate, owing to dislocations, the elevated or continental parts of the crust from the sunken or oceanic parts in such a manner that it is along these lines that earthquakes are concentrated at the present day, a witness to the necessary movements which are taking place in the contiguous divisions.

This, however, is going beyond our sphere, and we hasten to return to it by recognizing that, in spite of the difference of point of view to which attention has been called, Mr. Mellard Reade's work is that of an eminent thinker, and one which will be read with profit by all who are interested in the fundamental problems of geology.

A. DE LAPPARENT.

A GENETIC CLASSIFICATION OF VOLCANOES.

Alphons Stübel, 'Ueber die genetische Verschiedenheit vulkanischer Berge. Pp. viii., 78. Leipzig: Max Weg. 1903.

The author of this book is a well-known authority on the volcanoes of Ecuador and Central America, and has devoted much attention to the fundamental causes of volcanic action and the interpretation of volcanic structures. The present work contains a general study of the whole question, together with the application of the theories expounded to the special case of St. Vincent and Martinique. The standpoint of the writer is philosophic and expository rather than descriptive, and though the chapters referring to the West Indies show a general grasp of the literature of the subject, many views are advanced which a fuller knowledge of the area in question and a personal examination of the ground would have shown to be untenable. Of this we may mention a few instances. The cause of the violent blast which razed St. Pierre is supposed to be the stormy trade wind, but in the end of August a similar blast overtook Morne Rouge and other villages on the *east* of the mountain—that is to say, it must have travelled at right angles to the course of the trade wind. The great radiating ridges on the Soufrière are held to be lava-flows, and a great caldera is located on the north side of the Grand Bonhomme. These assertions will astonish those who have examined the island of St. Vincent.

The real object of the author, however, is to expound the importance and wide-spread occurrence of the monogenic type of volcano. These are the result of the discharge of a single reservoir of molten rock, situated at some depth within the crust. The eruption may last for only a brief time or may continue for a prolonged period, but is essentially a single outburst. Many of the greatest volcanic mountains of the world are supposed by the author to be monogenic, or to have at least a monogenic nucleus. Should subsidence ensue after activity ceases, a great "caldera" is formed; otherwise the monogenic volcano is usually a flat dome of various shapes. Monte Somma is cited as an instance of monogenic development; Vesuvius is due to a second phase of activity; these conclusions are opposed, of course, to the opinions of those who have most carefully studied the structure of this mountain. Though many eruptions have been carefully recorded in the literature of geology, few of them bear the monogenic stamp, but the great outburst of Krakatoa is regarded as belonging to this order. The work contains also a discussion of the origin of the lunar craters and the light they throw on the earlier stages of the Earth's history. Altogether we may say that the book is interesting rather than convincing, and that, though the great erudition of the author is visible on every page, there are many points which he leaves obscure.

J. T. F.

THE MONTHLY RECORD.

EUROPE.

The Origin and Meaning of the Name "Flanders."—The origin of the words Vlaming and Vlaanderen, the indigenous forms of the English Fleming and Flanders, have long been a subject of discussion, various conclusions having been arrived

at by those who have approached the subject from the point of view of etymology. The latest contribution to the question is that of Mr. J. Vercoullie, printed in the *Bulletin de la classe des Lettres* of the Royal Belgian Academy of Sciences. This writer points out that the words Vlaming and Vlaamsch are evidently derived from an original form Vlame, the antiquity of which is proved by the German and Danish terms Flamländer and Flamlænding; and, contrary to the recently expressed opinion of Mr. S. Muller, he holds that the same is the case with "Vlaanderen," in which the suffix -der, denoting the agent in Germanic languages, has been, in his opinion, added to the primitive root. The derivation from the Latin "planariæ" (plains) will not hold from the point of view of philology, firstly because the use of the epenthetic *d* is much later than the origin of the term, and secondly because the change of *p* into *f* or *v* would point to the existence of the term prior to the coming into force of Grimm's law. It is also unsuitable because the term did not apply originally to the Flemish flat country as a whole, but only to a small corner of it. Mr. Vercoullie gives reasons for believing that Vlaanderen has its origin, not, as some have supposed, in the name of the country, but in that of the people, Vlaander being the equivalent of Vlaming. This is borne out by the use, during the middle ages, of the Latin "apud Flandros," "in Flandris," etc. As regards the meaning of the original form Vlame, he also disputes the opinion of Muller, who connects it with German forms flāman, or flēman, and with the Greek πλήμων, πολέμων (warrior); preferring the explanation given by Gibson and Kervyn, who connect it with the Anglo-Saxon fleam (flight) and its derivatives flyma and flyming (fugitive). The vowel *a* would point to the Frisian dialect, and the name would therefore apply to a section of the Frisians, who, separated from the rest of their nation by the Schelde estuary, might well be known as Vlamen—that is to say, "profugi," or "exules."

ASIA.

Lake Aral.—The report of the Russian Geographical Society for 1902 contains further particulars as to the results of the Aral expedition sent out by the Turkestan Branch of the Society. We have already mentioned the discovery by L. S. Berg of the mark placed by Tillo in 1874, and the conclusion drawn by him that the level had risen since then by 1·21 metre. As the decrease of the lake was in full swing even in 1885, and, from various evidence, M. Berg takes it that the rising of the level of the Aral began only after 1891, it must have progressed at the rate of about 20 cm. a year. In the spring of 1901 the level rose still more, and the waters of the Aral filled up the desiccated lakes Chumysh and Khanturt, covering the ground which had been chosen for the building of the railway. Lake Klych, which is 1·5 metre below the present level of the Aral, will probably be also filled with water from the main lake if the level of the latter rises still higher. Owing to its small depth (less than three per cent. of the surface have a depth of more than 30 metres), the surface temperature of Lake Aral varies considerably with the seasons, widely differing from that of the bottom. Thus, on July 19, at a depth of 23 metres, the difference reached 10° C., and it was fully 18° at a depth of 31 metres in the western portion of the lake. In the winter the conditions are reversed, and consequently there is a time in the spring and the autumn when the whole mass of water must have an equal temperature. This was found to be the case at one spot in September, when the temperature was 18°·8 at all depths down to 23 metres. As to the specific gravity of the water, the figures obtained for the central parts of the lake were the same as the preceding year, *i.e.* from 1·0076 to 1·0080, while near the shores, and especially in sheltered bays, a specific gravity as high as from 1·0084 to 1·0090, and even 1·0094 was observed. The colour of the water was, in places, intensely blue, but the muddy waters of the

Sir-Daria spread far in the lake, changing its colour to green. The strongest current observed was 3 kilometres per hour, but only to a depth of 10 metres. The plankton of Lake Aral is poorer than that of European lakes, and the animals remain during the daytime at certain depths, coming to the surface only by moonlight. Quite a number of forms, hitherto known only from the Caspian sea, and only lately described by Sars, were discovered by S. A. Zernoff, who has studied the collections. Dragging has produced only the *Cardium edule*, two species of *Dreyssena*, *Adacna vitrea*, *Hydrobia stagnalis*, two species of *Gammarus*, and larvæ of *Chironomus* and of an *Oligochetes* worm. A map including the latest researches has been prepared by Colonel Rodionoff, and was published, both separately and in the Moscow geographical review, *Zemlevyedenie*.

Northern Caucasia.—The last numbers of the *Izvestia* of the Russian Geographical Society (1903, I. and II.) contain two interesting papers on the highlands of Northern Caucasia. One is by V. V. Markovitch, and deals with Digoria, a little-explored portion of these highlands, and especially with its glaciers. The author gives a list of twenty-one glaciers, from 2 to 10 miles long (the largest is the Karagom glacier, which is over 6 miles long without its firn), nearly all of which he visited last year, and his descriptions contain most valuable lists of the plants found at different altitudes and in different valleys. The paper is accompanied by six beautiful photographs of mountain and glacier scenery. The other paper is by V. Th. Novitsky, and deals with the neighbourhood of Elbruz, which the author succeeded in climbing, and also contains lists of plants found during different parts of the journey.

Mr. O. Crosby's Journey in Central Asia.—On June 1, 1903, Mr. Oscar T. Crosby left Europe intending to reach Tibet *viâ* Chinese Turkestan. Once upon the great plateau, he hoped to reach some point near Lhasa. While *en route*, in Tiflis, he chanced to meet Captain Fernand Anginieur, of the French army, who was journeying as far as Andijan, terminus of the Trans-Caspian railway. Becoming interested in Mr. Crosby's plans, he proposed that they should travel together—at least, as long as his leave of absence would permit—a proposition which was cheerfully accepted. The travellers first formed a caravan at Osh, which is only one day's post-chaise journey from Andijan. Twelve days' travel over the Alai mountains brought the caravan to Kashgar. Here it was necessary to reorganize completely, the men and animals from Osh not being available for further work. This reorganization was effected without much trouble, owing to the kindness of Colonel Philip Miles, Indian Army, assistant (for Chinese affairs) to the Resident at Srinigar. From Kashgar the usual route was followed through Yarkand and Khotan to Polu, on the slope of the Kuen Lun mountains—thus far without trouble, which came fast enough thereafter in the way of loss of grain in mountain torrents, desertion of guide, death of ponies, illness of Captain Anginieur, exhaustion of provisions in unknown and uninhabited country. Having hoped to get fresh provisions in Rudok, the caravan was pushed on by the travellers after loss of grain, instead of being returned to Polu. The road to Rudok could not be found; nor, indeed, for thirty days any road whatever. Finally, the caravan, much reduced, was halted, while two men, riding the only ponies fit for use, were sent in search for help. After eleven days this came in the shape of three Kirghiz, with camels and fresh provisions. But they would not go towards Rudok, nor would they permit their animals to go. It was necessary to go northward, then southward over the Karakoram pass, thence into Leh, which was reached on November 2, too late to organize another caravan for a fresh start. Therefore the only addition to the map of Tibet which the travellers are able to make consists of the line followed across the Aksai Chin to the sources of the Karakash.

Climate and Vital Statistics of Hong Kong.—The Colonial Office report on Hong Kong shows last year to have been one of unusually heavy rainfall. The average is 77 inches for the last ten years; in 1901 it was only 55 inches, and in the year under consideration a fall of 97·50 inches was recorded at the observatory. The wettest months were May and August, in both of which over 26 inches fell, and the driest was February, with 0·02 inch. The greatest amount of rain falling on any one day was 8·06 inches, and on 223 days no rain fell. From March to August the relative humidity of the atmosphere averaged over 82 per cent. continuously, and the mean throughout the year was 75·6 per cent. On fifty-one days no sunshine was recorded; the mean throughout the year was 5·3 hours. The highest temperature of the year was 92·2 Fahr. on July 27, the lowest 40·5 on February 4. The estimated population at the beginning of the year, excluding the naval and military forces, and also the new territory, was 311,824. That of the New Territory is probably about 110,000. While the death-rate is 21·7 per 1000, the birth-rate is only 3·8—this curious disproportion being due to the fact that thousands of families in Hong Kong are represented by men only. There is a very remarkable, and, so far, unexplained preponderance of male over female births among the Chinese community, the proportion being 190 males to 100 females, while even among the non-Chinese the proportion was 111⅝ to 100.

Korea.—The attention now directed to Korea as a possible field of hostilities in the Far East will, no doubt, cause many of our readers to desire guidance as to the existing literature on that country. Unfortunately, some of the most valuable information is not available to English readers by reason that it is written in Russian or Japanese. Thus the most exhaustive account of the country that has yet appeared was issued by the Russian Ministry of Finance in 1900, in three bulky volumes, a short analysis of their contents being given by Dr. Bretschneider in *Petermanns Mitteilungen* for the following year. Of books of travel in English, in addition to Mrs. Bishop's well-known work ('Korea and Her Neighbours,' Murray, 1898), there is the account by Captains Cavendish and Goold-Adams of a short journey in 1891 ('Corea and the Sacred White Mountain,' Philip, 1894), illustrated by a striking series of reproductions of native sketches of Korean life; while a short study of political and other conditions in the country appeared in 1898 ('La Corée,' Hachette), from the pen of M. Villetard de Laguérie, correspondent of the *Temps* during the Chino-Japanese war. A paper by Mr. Christopher Gardner, printed in the Report of the Australasian Association for the Advancement of Science in 1895 (pp. 483–532), also deserves mention. 'Quaint Korea,' by Louise J. Miln (1895), is a series of popular sketches based on a visit to the country. The best study of the broad physical structure of Korea is that of Mr. Koto, published last year in the *Journal* of the College of Science of the Tokyo University, and lately noticed in our *Journal*. Other papers by the same author have appeared (in Japanese) in the *Journal* of the Tokyo Geographical Society. Many papers, describing journeys through portions of the kingdom, have appeared from time to time in geographical serials, including that of Mr. C. W. Campbell in the *R.G.S. Proceedings* for 1892. Another English journey in Korea was that of Mr. Consul Willis, an account of which appeared as a Foreign Office Report in 1897.

The Bering, Okhotsk, and Japanese Seas.—Mr. P. J. Schmidt contributes to a recent issue of the *Izvestia* (1903, part 2) of the Russian Geographical Society a valuable paper on the physical geography of these seas, as far as they are known from previous and recent explorations. He adds to it a list of 133 species of fishes which have been found in the three seas, and of which a hundred are represented in his own collections.

Volcanic Eruption in Kamchatka.—In a paper contributed to vol. vi. of the *Memoirs* of the Amur branch of the Russian Geographical Society, Mr. A. Silnitsky makes some interesting remarks on the great eruption of the Avachinsk volcano in Kamchatka, which took place from July 20 to August 4, 1901. Lava began to flow from the volcano twice, and volcanic dust was thrown out in such quantities that it covered—the author says—every blade of grass and every leaf over the whole surface of southern Kamchatka. The author saw it as he travelled there in the first half of August. This dust seems not to have given a disagreeable taste to grass, as the cattle ate the grass as usual, but felt no ill effect. There was not a man in that region who did not cough from the effects of the dust, the cough being quite different from a cold. Numbers of fish also died from the effect of the volcanic mud, which had reached the river Avacha.

The Roads to Tibet: Errata.—In the paper on Tibet which appeared in the January number of the *Journal*, the following corrections should be made: On p. 81, 10 lines from bottom, the date should be 1902 (September); p. 85, 4 lines from bottom, for 313 read 213; p. 89, line 16, the height is, of course, 29,002.

AFRICA.

Proposed Expedition to the Lake Chad Region.—Lieut. Boyd Alexander and Captain G. B. Gosling are about to leave England for an expedition through Northern Nigeria and the Lake Chad region, accompanied by Lieut. Claude Alexander (holder of the R.G.S. diploma), and a Portuguese collector. The objects of the expedition are, in the first place a survey of the country traversed, and in the second zoological research, with a view to defining, if possible, the boundary between the tropical West African faunal region and that extending across the continent from the Nile to Senegambia, as to the exact position of which little is so far known. In the course of this investigation valuable information on the fauna of Northern Nigeria will, it is hoped, be obtained. The programme also includes the collection of photographs of native types and topographical details, and of general information on the inhabitants, their distribution, numbers, etc. The proposed route is by way of the Benue, Gongola, and Yo Komadugu to Kuka, a halt of some duration being made at Tonga, on the Gongola, for the purpose of survey and zoological work. From Kuka, which it is hoped to reach by October next, the route will be continued, should the conditions allow of it, through German Bornu to the Shari, the Logone being then ascended, and its connection with the Benue by way of the Kebbi investigated, in order to test the navigability of the Kebbi and Benue in the dry season. For the purpose of river surveys, two steel boats are being taken from England. Although it is proposed to extend the work as far eastward as possible, care will be taken not to excite native feeling by a too rapid progress through a little-known region.

Captain Lenfant's Expedition.—News has been received in Paris of the safe arrival on the Shari of Captain Lenfant, who had successfully navigated the channel connecting the Benue and Shari systems, thus proving the existence, at one time of the year at least, of a through water-communication between the ocean and Lake Chad.

Commemoration of Explorers at Timbuktu.—We have received the following communication from Captain C. F. Crombie, H.B.M. Consul for French West Africa: "I think it will interest the Society, of which I have the honour to be a member, to learn that, being on a voyage of inspection in the French Sudan, I arrived at Timbuktu in time to be present, on November 29, at a most interesting ceremony. The authorities of the 1st Military Territory, of which Timbuktu is the capital, had prepared commemoration tablets to be placed on the houses which

had been inhabited by the various explorers who had visited Timbuktu before the French occupation, and they invited me to be present at the ceremony of affixing them to the houses. Accordingly, at about 10 a.m. on November 29, I accompanied the officers and witnessed the placing of tablets on the houses which had been inhabited by—(1) Major Gordon Laing (British), who visited Timbuktu in 1826, and was subsequently murdered by order of Uld Mahomed, chief of the Berabich tribe, on the road to Arauan; (2) René Caillie, 1828 (French); (3) Barth (German), 1853–54; (4) Lenz (Austrian), 1880. The tablets are of wood, fixed to the wall by iron stanchions. They bear a painted inscription with simply the name and date. For instance, Laing's tablet has 'Laing—1826.' The tablets are about 18 inches by 12 inches. There were present at the ceremony Lieut.-Colonel Dagneaud, commanding the 1st Military Territory; Captain Carnus, of the 2nd Regiment Tirailleurs Senegalais, commanding the circle of Timbuktu; Alfred Seidon, the chief of Timbuktu, who was present at the original surrender to the French in December, 1893; and myself. I expressed my gratification at having had the good fortune to assist at this interesting ceremony."

Egyptian Public Works.—Sir William Garstin's annual report on the Egyptian Public Works Department for 1902 (Cairo, 1903) records the accomplishment of as large an amount of useful work as any of its predecessors. As usual, the first part of the report deals with the irrigation services, and offers a special interest by reason that the great reservoir down at Assuan and the barrage at Assiut were first brought into operation during the year under review. In 1902 the Nile flood was deficient for the fourth time in succession, the unusually low level with which the year began being maintained throughout the early summer, and it was only a fortunate change for the better at the last moment which saved the situation. The maximum was reached at Assuan as late as September 17, and the level was the lowest recorded in any year except 1877 and 1899. The lateness of the rise, together with the slow fall which followed, was, however, very beneficial to the basin irrigation. Special measures were, of course, needed in order to make the best use of the scanty supply, but so successful were these that no serious loss of crops resulted. In middle Egypt crops to the value of £600,000 at least were saved by the prompt action of Mr. Webb in closing the gates of the newly completed Assiut barrage, which has thus already repaid a large proportion of its original cost. Illustrations are given of both the new dams as completed. The filling of the Assuan reservoir was commenced on October 20 (with a level of R.L. 94·80), an early date being fixed on account of the low level of the river; and by January 31, 1903, the full level of R.L. 106·00 was attained. The report gives information as to the gauges which have been established both in the Sudan and on the Victoria Nyanza. Much valuable information is to be expected in future from these gauges, though the records have hitherto lost much of their value by lack of continuity, and, in the case of the lake gauges, by the absence of any sure basis of comparison. Sir H. Brown has made a calculation (based, however, on one year's observations only) of the varying times taken by the water to travel from Khartum to the delta barrage, the figures showing a gradual decrease from forty-two days in May to fourteen days in September. Another interesting matter dealt with is the attempted reclamation of the salt lands of the Wadi Tumilat, which has been in progress four years with most satisfactory results. In 1899 less than one-third of the total area of the Wadi estate was cultivated, and much of this was far from good. As a result of improved drainage and irrigation, the good land has become better, the poor land is now good, and the former uncultivated area has been diminished by one-half. Plates are given illustrating the process of reclamation. A report on the agricultural light railways shows that the mileage has increased from 54½ miles in 1897 to 673 miles in 1902, while the traffic has far exceeded expectations.

The Geology of Sokotra.—Dr. Franz Kossmat, who accompanied the expedition of the Austrian Academy of Science in 1898–9, has published a very full description of the geology of this island. Sokotra consists, as is already known, of the Haggier range, a granite mass with later intrusive rocks lying near the north coast; a plateau region of Cretaceous and Eocene formations extending over the greater part of the island, one or two Quaternary plains, and two small areas of crystalline rocks at the west end. The Cretaceous and Eocene rocks have been disturbed by three upheavals, which have exposed the crystalline rocks of Kalansiye and Rahmen at the west end of the island and the Haggier mountains, the axis in all cases running from west-north-west to east-south-east. There is so little bending of the strata that it might be supposed that the dip is due to their deposition on a previously tilted base rock, but the angle of the dip and other circumstances tell against this view. Probably, like the "swells" in the North American plateau region, these upheavals have been produced, not by tangential pressure, but by vertical movements. One large dislocation was observed at Ras Mumi, and others probably exist. The evenly bedded limestones of the Cretaceous and Eocene systems form typical plateau mountains with steep flanks, and exhibit a normal erosion and drainage; the Karst phenomenon is imperfectly developed, probably in consequence of the alternations of complete drought with heavy rains, which promote surface erosion. Dr. Kossmat collected fossils which abundantly prove that the plateau limestone is of Cretaceous age and not "probably Miocene," as stated in the work of Prof. Bonney, who had only Foraminifera to judge by. Intrusive rocks nowhere penetrate this formation. The fauna of the Cretaceous rocks of Sokotra is interesting in relation to the former existence of a land connection between India and Africa over the Seychelles and Madagascar. The limestone is a Mediterranean formation, similar to those of Syria, North Africa, and Southern Europe, and distinct from the Cretaceous rocks of the Indo-Pacific region. MM. Boule and A. de Grossouvre have certainly found fossils in Madagascar which prove that the Cretaceous rocks of the island belong to the Indo-Pacific region. The theory of a land barrier may, then, have to be abandoned, but the fact remains that the Cretaceous rocks of Sokotra, of Ras Fartak in South Arabia, and of the Narbada in Western India, are closely connected with those of the eastern Mediterranean, and differ essentially from those of Southern India, and some cause or other must have kept the two faunas apart.

The Uganda Protectorate.—From the recent report on the Uganda Protectorate (Africa, No. 15, 1903), we learn, among other matters, that during the year under notice preliminary work in connection with the survey of the kingdom of Uganda was commenced. The base line was located in the Maanja valley, some 40 miles north-west of Kampala, and chainage was completed in January of last year. The elevation of the base line above sea-level was determined, and about 1800 square miles of country were prepared for theodolite observations. A survey of the Kampala township, on a scale of 1 : 2500 was also completed. By means of the steam-launch *Kenia*, which after repairs was replaced on the Nile, and two other vessels, connection was established between Butiaba, on Lake Albert, and Wadelai and Nimuli. Between Nimuli and Gondokoro the Nile is not navigable, and communication is kept up by road. The following roads, made by hut-tax labour, were completed during the year: Entebbe to Jinja, 51½ miles; Kampala to Masaka, 80 miles; Masaka to Mbarara, 83 miles; Masaka to the German boundary, 55 miles, a total of 269½ miles. During the year telegraphic extension was made connecting Kampala with Hoima, the capital of Unyoro, and Butiaba, a distance of 157½ miles, with a branch line 31¾ miles long from Hoima to Masindi, an important trading centre on the trade route between Kampala and the Nile. We

are told that during the present year the telegraph line will be extended to Wadelai, and later be projected to Nimuli and Gondokoro, to eventually establish communication with the Sudan and Egypt.

Position of Lagos.—We have been favoured by the Intelligence Division of the War Office with the results of a recent determination of the geographical co-ordinates of Lagos, which have thus for the first time been ascertained with precision. The transit pier at the observatory for which the co-ordinates were fixed lies 1549·9 links south, and 3261·4 links east, of Christchurch, Lagos, and the values obtained were: latitude, by circummeridians, seven nights, 6-inch theodolite, 6° 26′ 38″·7 N.; longitude, by telegraphic exchange with the Cape observatory on two nights, 13′ 35″·32 E., or, in arc, 3° 23′ 49″·8 E. It is to be hoped that similar determinations will be made as soon as possible at many more of the African stations at which the telegraph is now available.

AMERICA.

The Fall-line in the Southern United States.—The fall-line region is bounded on the west by the Blue Ridge, and on the east by the Atlantic ocean, and extends from New Jersey to Georgia, and perhaps further. The surface at the foot of the Blue Ridge has a height of nearly 600 feet, and it sinks gradually to the coast. The higher part at the east of the Blue Ridge is known as the Piedmont plateau. The rivers are navigable in their lower reaches for some miles inland up to the fall-line, where the water suddenly becomes shallow, and rapids and waterfalls stop navigation. Above the zone of rapids the streams are of small depth, and are crossed by numerous bars of rock. Here every stream has a normal concave curve of fall, and in the zone of falls it descends to the lower plain by a convex curve, lowering its level considerably within a short distance. The Piedmont plateau adjoining the fall-line consists of a series of gneisses, schists, and phyllites, marble, slates, and pegmatite dykes, which to the east dip below loose, nearly horizontal Tertiary strata. These deposits reach down far below the present sea-level, and have been deposited during various invasions of the sea. The coastal plain seems then to have been brought into existence by a comparatively recent upheaval, and the present coast-line by a still later subsidence. The Piedmont plateau is a gently undulating surface, a peneplain, rising from an average elevation of 230 feet at the fall-line to about 1200 at the Blue Ridge. Towards the west the rivers flow in fairly broad valleys, while towards the east they have cut themselves out deep troughs. The coastal plain is flat, with a surface sinking eastwards from a height of 150 feet to sea-level in 110 miles. The rivers have formed deep valleys with steep flanks. In these the sea has penetrated almost to the fall-line; in the north, indeed, the tide reaches the line. The now half-sumberged valleys form arms of the sea, such as Delaware and Chesapeake bays, and many of the shores are steep owing to the erosion of the waves. Surveys show that there has been of late years a marked encroachment of the sea, and the New Jersey coast is sinking at the rate of fully 11 inches in a century. The fall-line might have been caused by faulting. The present surface of the crystalline rocks is not visible east of the fall-line, as though it had been bent down, and the submarine continuation of the Chesapeake and Delaware valleys indicates that this part of the land has been recently submerged. But the stratigraphical evidence of down-thrusts large enough to produce the fall region, 80 to 100 feet high, is almost everywhere absent. Another view is that the region of the fall-line is a transition zone between the older streams and the new river system, called into existence by the elevation of the coastal plain. The normal line of fall has not yet been reached, but will be sooner attained in the lower lands, where the deposits are more easily eroded, and

where the part of the underlying crystalline which rises above the normal curve will soon be laid bare. This explanation accords with the fact that the fall-line, especially in the south, coincides with the western boundary of the coastal plain, but it does not sufficiently account for the subsidence of the coast-line, still probably in progress in some parts, and the upheaval of the adjoining region west of the fall-line. Mr. Cleveland Abbe, jun., from whose paper in the *Vierteljahrshefte für den Geogr. Unterricht*, Heft iv., 1903, this note is taken, inclines, therefore, to the opinion that tectonic movements and erosion have co-operated in forming the fall-line. Since the earliest times of the English colonization this line has been an obstacle to traffic, necessitating the transhipment of goods to waggons and canal boats, and therefore small seaports sprang into existence at the points where the rivers ceased to be navigable. As trade increased some of these became important commercial towns, such as Albany, Philadelphia, Trenton, Richmond, etc. Within the last twenty years the falls have furnished motive power to factories, and raw cotton is being manufactured in increasing quantities, instead of being shipped to the northern states or abroad.

Control of the Mississippi.—Addressing the Franklin Institute on June 17 last, Prof. L. M. Haupt gave some pertinent advice as to the regulation of the Mississippi. His advice is based on the principle that if the outflow exceed the inflow capacity there is no overflow; but, contrariwise, if poured in at the upper end faster than cleared at the mouth, the water is dammed back and its velocity retarded. Seeing that the slope of the river diminishes as it approaches its mouth, the coarser gravels and shingle in the higher reaches, not carried into the gulf, settle in the bed and raise its level. Advocates of high levees urge that the levees control the floods and cause compensation for increased volume by deepening. Against this increasing height of floods and levees, he points to silting up of the bed; and, given an increasing scour in the higher reaches, the reduced slopes (almost negative) towards the mouth arrest movement and induce a rise in the flood-plane. Cross-section shows how, in accordance with the law of fluviatile sedimentation, the banks attain highest elevation along the border, falling away in the distance at the average rate of 3 to 4 feet a mile. The volume of sediment carried into the gulf annually is computed at 250 to 278 million cubic yards. The banks, again, are caving at the rate of about 9 acres per mile of river, and their height averages 30 to 45 feet. This gives 332 million cubic yards of sediment allotted to the bed of the stream, independent of the much greater amount fed by the tributaries. Prevented by levees from spreading beyond the bank, the net amount of sediment left in the bed would therefore exceed the amount deposited in the gulf. Excess of injecta over ejecta measures the growth of elevation of bed. In the outlet reach from Red river mouth to the gulf the fluctuations are reduced to less than half of those of the higher reaches, the channel is far more permanent, and the protection much more effective. This is due to the safety-valves afforded by the various outlets, which are, however, unhappily, slowly filling from the sedimentation of the overflowing waters. The remedial measures suggested by Prof. Haupt are directed towards the prevention of simultaneous floods and accumulation of large volumes of water to be carried long distances in a congested conduit. There are needed, to fulfil this requirement, a combination of impounding reservoirs on the tributaries, especially of the western sections, where they are utilizable for irrigation; reforestation of the arid regions; levees with readjusted alignment, and low weirs at suitable points for the spill-ways, to be connected with large subsiding reservoirs in the swampy bayous; and, finally, removal of the bars at the delta and opening of all possible outlets to allow a rapid clearance of excess of floods.

AUSTRALASIA AND PACIFIC ISLANDS.

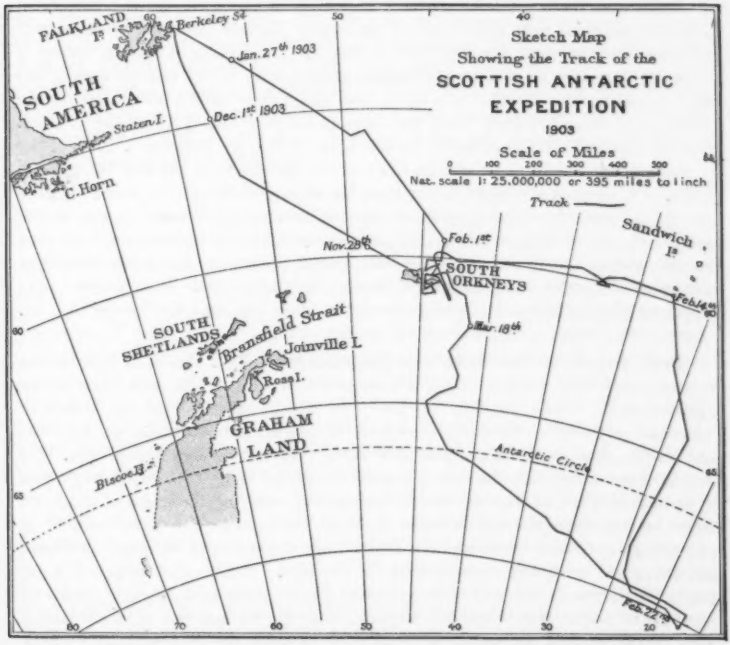
Longitude of Honolulu.—In the issue of *Science* for November 6 last, Dr. J. F. Hayford refers to the recent determination of the longitude of Honolulu by Messrs. Smith and Morse of the U.S. Coast and Geodetic Survey, by means of the new Pacific cable, comparing the results with those of former observers through the past three centuries and a half. The older results have been reduced for purposes of exact comparison to the latest observation point, the transit of Venus station. The position assigned to the Hawaiian group by the early Spanish navigators was of course based on no accurate observations, and it is not surprising to find that the Spanish chart published with the narrative of Anson's voyage places the group which may be supposed to represent Hawaii, 17° too far east. Cook, 1785, was still 4′·5 in error, his position being this amount too far west. Freycinet, 1819, came within 15″ of the truth; while Captain Tupman, of the British Transit of Venus expedition of 1874, reached a result agreeing to the tenth of a second of time (1″·5 of arc) with the most recent result. It is calculated that this result, which places the Transit of Venus pier in 10h. 31m. 27·24s. (157° 51′ 48·6″) west of Greenwich, is probably correct within 0·06s. (85 feet), and almost certainly within 0·2s. (283·6 feet).

POLAR REGIONS.

Baron Toll's Expedition.—The St. Petersburg newspapers of January 16 contained the following telegram, dated Yakutsk, January 15: "To-day arrived Byegacheff, boatswain of the boat expedition of Lieut. Kolchak, who is also coming here soon. The search for Baron Toll on the New Siberia islands and in Bennett Land was fruitless. Toll has left papers on Bennett Land, from which it appears that he left it on November 8, 1902, going southwards. Brusneff's party returns with that of Kolchak." This telegram cannot but cause the gravest apprehension, nothing having been heard of Baron Toll for the last fourteen months.

The Scottish Antarctic Expedition.—Letters received from Mr. Bruce in Edinburgh early in January give a detailed account of the course of the expedition from the date of its leaving the Falkland islands, on January 26, 1903. The first two months were spent in cruising in the seas to the southward, much of the time amidst heavy pack-ice, which thoroughly tested the qualities both of the captain (Captain Robertson) and of the ship. On February 2 the pack-edge was reached in 60° 20′ S., 43° 50′ W., and a westerly course steered along it for 30 miles, the *Scotia* then heading southward into it. During the 51 days' cruise, extending over some 5000 miles, soundings were frequently taken, the result being to show that, as had been anticipated from Ross's single sounding further to the east, a deep sea with a more or less uniform depth of 2500 fathoms lies between 60° and 71° S. in this region. On reaching the South Orkneys a landing was effected, for the first time since Weddell's visit in 1823, on the north side of Saddle island. The island itself was clear of ice, but Saddle island bay and Washington straits were full of ice. A large rookery of ringed penguins was found, with many young and some eggs, while cape pigeons, sheath-bills, and skuas were also nesting, and apparently also the dominican gull, giant petrels, and shags. The last-named was the blue-eyed shag, which is thus for the first time proved to be the species inhabiting the Antarctic lands. Mosses and lichens were gathered, and two insects (*Collembola* and *Acurina*) found. The cruise being resumed, a wide sweep to the eastward was made in order to get clear of the pack, the edge of which was followed in the vicinity of

60° S., until, in about 26° 10′ W., it was at last possible to run southward. On February 18 the antarctic circle was crossed, with only three icebergs in view. The temperature soon falling, and "pan-cake" ice forming rapidly, the *Scotia* was temporarily beset, but, again becoming free, pushed to 70° 21′ S. in 17° W., where, at the furthest south reached, a sounding of 2543 fathoms was obtained. A retreat was then decided on, and the South Orkneys were again reached on March 21, fairly low temperatures being experienced during the whole of this period, with a minimum of 6°·9 Fahr. on March 13. The winter quarters were established in a bay on the south coast of Laurie island, where the ship was soon firmly frozen in, so remaining for no less than eight months—a remarkable fact, considering that the latitude was only between 60° and 61°, and the island an oceanic one. Mr. Bruce supposes that the continuous ice-sheet, extending down to Graham's Land in the south-west,



brought about a temporary occurrence of continental conditions. A specially constructed magnetic observatory of wood and copper (named the Copeland observatory) was soon set up, and a stone dwelling-house built, the walls having a minimum thickness of 4 feet. Such is the solidity of its construction that Mr. Bruce considers that it will last for centuries, and possibly prove of further use either as a base for explorers or a refuge for shipwrecked sailors. Regular scientific observations were carried out throughout the winter, and in the spring a careful survey was made of the neighbourhood of Laurie island and of the east and south coasts of Coronation island. This work was much impeded by the persistence of foggy weather and low-lying stratus clouds, while the great variations of temperature (40° to 60° in a single day) were also trying. The whole surface of the group is described as precipitous, composed of rugged and serrated hills covered with snow

and glaciers. The ice finally broke up and cleared away in a single day (November 23), the ship at once proceeding north to refit, while Mr. Mossmann and five others remained to continue the scientific work. The Argentine Government has treated the expedition with great liberality, and has sent four scientific men to take part in the work on the South Orkneys.

The French Antarctic Expedition.—During his stay at Buenos Aires, *en route* for the Antarctic, Dr. Charcot drew up a statement of the proposed programme of his expedition, a copy of which he has communicated to us. The main attention will be paid to the western side of Graham Land, which it is proposed to reach either by way of Belgica strait or of the outer coasts of the Palmer archipelago, which have not yet been examined. During the voyage southward from Flanders bay (at the southern end of Belgica strait) towards Adelaide island and Alexander I. Land, a careful examination will be made of the inlets of the coast, for the purpose of selecting the most favourable spot for the winter quarters, to which a retreat will be made not later than the first half of March. During the Antarctic spring of 1904 land expeditions will be undertaken, either across to the eastern side of the land adjoining the Weddell sea, or, in case the winter station should be further south than 66°, southward along the coast in the direction of Alexander I. Land. Similar explorations will probably be continued during the summer of 1904–5, but a return north will be made in time to avoid the possibility of the ship being again beset. Dr. Charcot mentions, as the spots at which efforts will be made to leave records (in case of a relief expedition proving necessary), Wiencke island, at the south-west end of Belgica strait; Pitt island and Adelaide island, on the western side of Graham Land; and one of the Seal islands (preferably Christensen island), in the event of a strait being discovered leading to Weddell sea. It is possible that Seymour island, where a depôt of provisions has been left, may also be visited. Dr. Charcot left Buenos Aires for the south on January 21.

Prof. Penck on the Antarctic Expeditions.—Prof. Penck, of Vienna, has recently published a series of popular scientific articles in the *Neue Freie Presse* (December 17, 1903; January 14, 1904), in which, after tracing the history of Antarctic exploration from the voyage of Bellingshausen onwards, he considers the results obtained by the expeditions lately returned or now in the field. He emphasizes the fact that the expeditions of the period 1820–1843 could only claim to have been efforts at nautical-littoral exploration, studying the coasts of Antarctic lands as seen from the sea, whereas those of the present day have resulted in physical-geographical investigations, which have thrown light on many problems left untouched or merely suggested by the pioneers. While Ross might look on the Great Barrier as the wall of an extensive area of thick pack-ice, the journey of Scott made it clear that it was the edge of a vast glacier not less than 700 miles wide, which reached the sea by a great plain between the mountains of Victoria Land and Edward VII. Land. If d'Urville and Wilkes were not always sure whether they saw land or merely the edge of ice-masses, Drygalski has proved the existence of a completely ice-covered land in the far south, resembling in its character as to ice and snow the interior of Greenland. These voyages have made it clear that there is a seventh continent surrounding the south pole, how large we cannot yet tell, but probably larger than Europe. Prof. Penck touches on the name which should be applied to the southern continent. The name *Antarktis*, proposed by Ratzel, includes the whole of antarctic nature, ice and water as well as land. *Antarctica* is more consonant with the nomenclature of other continents, and to be preferred on that account. The meteorological results are summarized, and shown to be in harmony with the theory of an extensive continent. Prof. Penck lays stress on the fact that at present we only possess preliminary reports

of the work of the new expeditions, and that some time must elapse before the full importance of the work done can be estimated.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Proposed Monograph on Volcanoes.—An important publication dealing with the volcanoes of the world has been taken in hand by the 'Société Belge d'Astronomie, de Météorologie et de Physique du Globe,' at the instance of M. Reclus. It will take the form of an Atlas of Volcanoes, accompanied by a notice and detailed descriptive tables. The general distribution of volcanoes will be shown on a world-map on the scale of 1 : 40,000,000, and on ten regional maps on the scale of 1 : 2,000,000, while the more special features will be dealt with in block-maps accompanying the text. This will, it is contemplated, occupy with the tables some 300 pages, large 8vo. For the collection of the necessary material the society relies on the co-operation of correspondents throughout the world, while in order to secure the required funds, subscriptions are asked in advance, two copies of the atlas being allotted for every 100 francs subscribed. Of the scientific value of such a work, enjoying as it does the guarantee afforded by the great reputation of M. Reclus, there can be no doubt, and we cordially wish success to the promoters of the undertaking.

The Effect of the Earth's Rotation on Sea Currents.—Dr. V. Walfrid Ekman has endeavoured, in a treatise written for his doctor's degree at Upsala, to show mathematically the circumstances attending the deviation of sea currents from the direction of the wind. The latest observations on this subject are those of Dr. Nansen, who noticed that the currents diverged 20° to 40° from the direction of the wind, and further argued that as the movement was propagated downwards each layer of water moves over the one below it, just as the wind does over the surface water, and that the lower layer must deviate to the right from the one above it, so that at great depths the current will flow in a direction contrary to the wind, diminishing the power of the wind to produce sea currents, at least in high latitudes. Dr. Ekman has strictly limited his conditions in order to make his equations easily reducible, and his conclusions are therefore sometimes unreliable, at least except as showing the general principles. Assuming that the depth of the sea is invariable, he finds that the depth of the current is least at the pole and gradually increases towards the equator, where, theoretically, it extends to the bottom. It depends also on the coefficient of friction. On the other hand, it is independent of the strength of the wind. This absurdity arises because the equations are linear, the area supposed to be so small that the rotundity of the Earth is not perceptible. In reality the depth of the current increases in some ratio to the force of the wind, while the friction increases with the velocity. The velocity of the surface stream is proportional to the wind force, and increases towards the equator in the same proportion as the depth of the stream. The angle of deviation is constant (45°), whereas one would expect it to diminish with the diminution of the effect of rotation. But the deviation depends, not on the vertical component of the rotation alone, but on the product of this and the current's mass and velocity, which is constant. This will not be the case if the depth of the sea be considered variable. There is great difficulty in determining the coefficient of friction. Taking the value adopted by Zöppritz, namely, 0·0144, the centimetre, gramme, and second being the units, Dr. Ekman finds that the depth of the surface current would be only 22 cms. at the pole, and 35 cms. at the tropics. With a revised estimate of the coefficient of friction, however, Dr. Ekman finds that the depth of current would be 230 metres (nearly 547 feet) at lat. 60°.

GENERAL.

The Scottish Geographical Society.—We have much pleasure in recording the appointment, early in January, of Lieut. E. H. Shackleton as Secretary of the Royal Scottish Geographical Society, in the place of Colonel F. Bailey, who lately resigned the post.

Scottish Scientific Societies.—A project has lately been set on foot for the bringing together into one building all the scientific societies which have their headquarters in Edinburgh, and a meeting of the Fellows of the Royal Society of Edinburgh in support of the proposed scheme was held in the Society's rooms on November 26 last, the subject being introduced by a speech by Sir John Murray. As is well known, the Royal Society occupies a portion of the building known as the Royal Institution, which it shares at present with other public bodies, including the Board of Fishery, the School of Art, and the Society of Antiquaries of Scotland, the whole being under the general control of the Board of Manufactures. It has long been thought that the building should be exclusively devoted to scientific purposes, thus on the one hand securing a community of interests on the part of all its users, and on the other facilitating the work of scientific research by the centralization thus afforded, and the avoidance of the dissipation of energy which is to a certain extent the result of the present separation of the societies. It is held that, were the whole building given up to their use, it would be possible to find space for the housing of all the several libraries, including those of the Scottish Geographical and Meteorological Societies, besides allotting to each the rooms required for other purposes, and leaving the large central hall available for scientific demonstrations, lectures, and the like. The proposal found warm support at the meeting alluded to, and a resolution in furtherance of the above-mentioned aims was unanimously adopted.

The Geographical Association.—The Annual Meeting of the Geographical Association was held in London on January 6. The report for 1903 drew attention to the steady increase of numbers and the great loss which the Association had sustained through the death of Mr. Rooper. The most important event was the favourable reception by the Board of Agriculture to the memorial supported by Mr. Mackinder for the R.G.S., asking for the publication of cheap editions of the 1-inch Ordnance Survey maps for teaching purposes. The revised price list may be obtained by application to the Secretary of the Association, 4, Broad Street, Oxford. The president, Mr. Douglas Freshfield, then delivered his address, in which he congratulated the Association on the work of the past year, and pointed out some dangers to be guarded against, especially in matters of terminology. He emphasized the value of teaching excursions, the use of lantern slides, and explorers' descriptions, and complained of the lack of geographical training in the map craftsman. A discussion followed on the R.G.S. syllabuses in geography. Mr. J. L. Holland, of St. Olave's school, pointed out that, while all now admitted that there was an argument in geography, there was no agreement as to the stages in which it should be presented. The pedagogical order was not necessarily the logical one, and the general criticism he offered on the syllabus for higher schools was that it did not sufficiently consider the order of presentation from simple to complex, especially in the regional sections. Mr. A. T. Simmons believed that the compilers of the syllabus would themselves make geography of educational value by following it, but that ordinary teachers were neither geographical experts nor private tutors. Distance, time, expense, and weather all made more out-of-door study impossible, and many other suggestions were impracticable. What was wanted was a series of practical exercises for the classroom. Mr. White spoke from seven

years' experience in elementary work. He considered modelling took up too much time, but that sufficient stress was not laid on map-reading and the use of photographs. Miss Brooks, Marylebone P.T. school, gave an outline of her methods of carrying out geographical excursions. Prof. Lyde said that it would carry more conviction to the minds of practical teachers, and encourage them to try a syllabus which might seem impossible, if the name of some practical teacher still engaged in school work were associated with the syllabus. He also considered excursion out of the question. Mr. Chisholm drew attention to some of the misconceptions of the speakers as to the purpose of the syllabus, and pointed out that it was designed to show the importance of the argument in geography. The president and other office-bearers were re-elected for 1904, Mr. Mackinder being added to the list of vice-presidents.

Fifth Italian Geographical Congress.—Arrangements have been made for the holding of the Fifth Italian Geographical Congress at Naples during the early part of April of the present year, the opening meeting being fixed for the 6th of that month. The proceedings of the Congress will be grouped into four sections, the first dealing with scientific geography (physical, mathematical, etc.) and exploration, the second with the economic and commercial aspects, the third with pedagogy, and the fourth with the history of the science. As usual, a full report of the addresses and papers will be printed. The Fourth Italian Geographical Congress was held at Milan in 1901.

Orthography of Place-names.—A revision of the rules for geographical orthography in the German colonial possessions has lately been made, the new scheme, which has received the sanction of the German Chanceller, being printed in the *Deutsches Kolonialblatt* for September 16 last. The original rules were printed in the same periodical for August 15, 1892 (p. 407). With regard to the giving of names to places in the colonies, it is laid down, as in similar cases elsewhere, that native names are to be adopted, when possible, and that where no names exist, the names given by the first discoverers are, as a general rule, to be adhered to. The arbitrary change of long-established names is also to be avoided. As a rule, translations of foreign names into German are not to be made (though they may be given, in certain cases, in brackets after the name), except where they have a general significance, such as "great bay" and the like. As regards orthography, the alterations are all in the direction of a return to the common German orthography, not of a nearer approach to an international alphabet. This can only be approved as the wisest course, for, however useful a universal alphabet might be if once firmly established, the concurrent use, in one and the same country, of two different systems, the popular and the international, can only cause confusion, as has been abundantly shown since the first attempts in the direction of a universal alphabet were made. In the case of recent German maps, for instance, one can never feel sure, on seeing a new name written with the letter *j*, whether this is meant to be sounded as the English *y* or the French *j*. The new German rules re-introduce the combination *sch* (for English *sh*), *dsch*, and *tsch* being thus once more used for the English *j* and *ch*. However clumsy an appearance these combinations may present, they certainly have the advantage of removing all possibility of ambiguity. A return is also made to the ordinary German usage in the case of *ch* (guttural), *j*, and *w*, while *ss* is once more allowed for the sharp *s*, and *x* for *ks*; *v* and *y* are added to the list of consonants that may be dispensed with. Rules are also laid down to secure uniform usage in the cases of double names. Thus bucht, burg, etc., when forming part of the name of a settlement, are to be tacked on to the preceding word, but when designating an actual physical feature, to be written separately (thus Bismarckburg, but Lüderitz-Bucht). When three

words form a name, they are to be written thus: "Friederich-Wilhelmshafen" (if the name of a settlement), but "Friederich-Wilhelms-Hafen" (if the name is that of the piece of water as such). A parallel usage is adopted for Deutsch-Ostafrika and the like. The rules are not to apply to the Kiau-chou territory. It may be noted, also, that a definite series of rules has been adopted by the African society, the R.G.S. system being closely followed, with the exception that the indeterminate vowel sound (*a* in amount, *u* in but) is represented by *ă*, not *ŭ*: the longer vowel sound in curt by *ö*, the English *aw* by *ô*, *ch* by *c*, *ng* in ringing by *ñ* (to show that the letters are not pronounced separately). Some of these modifications will certainly be a help towards discriminating between the various vowel sounds, for which the English alphabet makes no adequate provision. It may be remarked that the combination *ñg* must be permitted, if the various sounds of *ng* in English are to be completely discriminated, there being otherwise no means of distinguishing the sound of the letters in "ingle" and "ingraft," in neither of which does it coincide with the sound in "ringing."

OBITUARY.

Dr. Wilhelm Hein (1861–1903).

Dr. Wilhelm Hein, an ethnologist widely known for his expedition to Southern Arabia, died on November 19, 1903. He was born in Vienna in 1861. He studied Arabic, archæology, history, and geography at the University, graduated in 1885, and then continued his studies in Strassburg under Prof. Euting. In 1887 he received an appointment in the Natural History Museum in Vienna, and at the same time took up the duties of Privatdocent in Ethnography in the University. His special subject was the history of ornament, and his work on the ornaments of the Dyaks of Borneo is well known. As the result of numerous journeys in Europe, he brought together and exhibited a collection of folk-plays, and in ethnological circles he was known for his studies of masks found among dwellers in the Alps. His wife was his collaborator in all his scientific work, and even accompanied him in his expedition to Southern Arabia, which he carried out with the support of the Academy of Sciences. On this expedition he was captured by the Sultan of Gishin (or Kishin), and released by the intervention of a British gunboat. In the middle of his working up of the rich cartographical, anthropo-geographical, and especially linguistic material which he had brought back from Southern Arabia, he was carried away by a painful illness. His last work, 'Contributions to the Statistics of Southern Arabia, Statistical Tables for Gishin, in Mahraland,' published in the *Mitteilungen* of the Vienna Geographical Society, bears witness to the subtlety and conscientiousness of his scientific investigations.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1903–1904.

Fifth Ordinary Meeting, January 11, 1904.—Sir Harry H. Johnston, G.C.M.G., K.C.B., in the chair.

Elections.—*John William Archer; Lieut. Hon. J. S. Coke (Scots Guards); Lancelot Fielding Everest, M.A., LL.D.; Joseph Massey Harvey; Francis John*

Haverfield, M.A., F.S.A.; Captain Ronald Henderson (3rd Hussars); Turner Henderson, B.Sc.; Grant William R. Ogilvie; Robert Charles Poole; Major Simpson Powell, M.D., R.A.M.C.; John Frederick Unstead, B.A.; Reginald Whaley Wickham; Isaac Julius Wimberg, J.P.

The Paper read was :—

"Exploration on the Borderlands of Southern Abyssinia." By Captain Philip Maud, R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *G. Abhand.* **8**, Heft 2 (1903): pp. 118. **Krebs.**
Die nördlichen Alpen zwischen Enns, Traisen und Mürz. Von Dr. N. Krebs.

Alps. *La G., B.S.G. Paris* **8** (1903): 166–167. **Marcel.**
La représentation de la chaîne des Alpes. Par G. Marcel.

Alps. *G.Z.* **5** (1899): 588, 631; **6** (1900): 325, 366; **9** (1903): 253, 332, 371. **Penck.**
Neue Alpenkarten. Von Prof. Dr. A. Penck.

Germany. **Baedeker.**
Northern Germany as far as the Bavarian and Austrian Frontiers. Handbook for Travellers by Karl Baedeker. Fourteenth Edition. Leipsic: Karl Baedeker; London: Dulau & Co. 1904. Size 6½ × 4½, pp. xxxviii. and 396. *Maps and Plans. Price* 8*m. Two copies, presented by the Editor and by Messrs. Dulau & Co.*

Germany. **Stumpfe.**
Die Besiedelung der deutschen Moore mit besonderer Berücksichtigung der Hochmoor- und Fehnkolonisation. Von Dr. E. Stumpfe. Leipzig und Berlin: G. H. Meyer, 1903. Size 9½ × 6, pp. x. and 470. *Maps. Price* 10*s.*

Hungary. *Archæologiai Értesitö* **23** (1903): 164–173. **Finály.**
Voies romaines dans la partie trans-danubienne de la Hongrie. Par Dr. Gabriel de Finály. [In Hungarian.] *With Map.*

Iceland. **Zugmayer.**

Erich Zugmayer. Eine Reise durch Island im Jahre 1902. Wien: A. W. Künast, 1903. Size 9½ × 6½, pp. 192. *Maps and Illustrations. Price* 4*s.*

The author crossed Iceland by two different routes.

Italy. **Villari.**

Italian Life in Town and Country. By L. Villiari. London: G. Newnes, 1902. Size 7½ × 5, pp. xii. and 262. *Illustrations. Price* 3*s.* 6*d. net.*

Describes the various sections of the population, their employments and modes of life.

Italy—Pompeii. **Engelmann.**

Pompeii. By Richard Engelmann. Translated by Talfourd Ely. London: H. Grevel & Co., 1904. Size 9½ × 7, pp. 112. *Illustrations. Price* 4*s. net. Presented by the Publishers.*

Italy—Tiber. **Magistris.**

Riv. G. Italiana **10** (1903): 123–132, 180–192, 251–255, 335–350.

Le torbide del Tevere e il valore medio annuo della denudazione nel bacino tiberino a monte di Roma. Notizia di L. F. de Magistris.

Italy—Venice. **Okey.**

Venice and its Story. By T. Okey. London: J. M. Dent & Co., 1903. Size 9½ × 7, pp. xvi. and 332. *Map, Plan, and Illustrations. Price* 21*s. net.*

An attractive and profusely illustrated account of Venice and its history, based, in respect of the latter, on the best authorities, including some of the old chroniclers. The illustrations, many of which are coloured, include reproductions of pictures by celebrated artists.

Mediterranean—Crete. *La G., B.S.G. Paris* **8** (1903): 143–147. **Laloy.**

La péninsule orientale de la Crète. Par Dr. L. Laloy.

Turkey—Macedonia and Albania. **Oestreich.**

Jahresb. Frankfurter V.G. u. Statistik **66 & 67** (1901–1903): 5–28.

Makedonien und die Albanesen. Eine politisch-ethnographische Skizze, zumeist auf Grund eigener Reiseeindrücke. Von Dr. K. Oestreich.

United Kingdom—Coal, etc.

Mines and Quarries: General Report and Statistics for 1902. Advance Proof (subject to correction) of the tables relating to the Output of Coal and other minerals, and the number of persons employed at mines worked under the Coal and Metalliferous Mines Regulation Acts during the year 1902. London: Printed by Darling & Son, 1903. Size 13½ × 8½, pp. 12. *Presented by the Under Secretary of State.*

United Kingdom—Devon and Cornwall. **Ward.**

Thorough Guide Series. North Devon [including West Somerset] and North Cornwall, from Exmoor to the Scilly Isles, with a description of the various approaches. By C. S. Ward. Eighth edition. London: Dulau & Co., 1903. Size 6½ × 4½, pp. xvi. and 160. *Maps and Plans. Price* 3*s.* 6*d. Presented by the Publishers.*

This is now provided, like others of the series, with contoured sectional maps.

United Kingdom—Yorkshire. **Sheppard.**

Geological Rambles in East Yorkshire. By T. Sheppard. London: A. Brown & Sons, 1903. Size 9 × 6, pp. xii. and 236. *Maps and Illustrations. Presented by the Publishers.*

An interesting and instructive little work.

ASIA.

Asia—Historical. *Imp. and Asiatic Quarterly Rev.* **16** (1903): 350–354. **Parker.**

The Early Christian Road to China. By E. H. Parker.

Asia—Political. **Chirol.**

The Middle Eastern Question; or, Some Political Problems of Indian Defence. By Valentine Chirol. London: John Murray. Size 9 × 6, pp. xiv. and 512. *Maps and Illustrations. Price* 18*s. net. Presented by the Publisher.*

Although mainly political in its outlook, this work will be valuable to the geographer for the masterly way in which it sets forth the geographical and other factors

of the question, such as the conditions of trade and means of communication in the regions bordering on India, while the author's recognized position as an authority on the East lends weight to his views.

Asia—Turks. *Imp. and Asiatic Quarterly Rev.* **16** (1903): 355–368. **Parker.**

The Western Branch of the Early Turks. By E. H. Parker.

Eastern Asia. **Halkin.**

Joseph Halkin. En Extrême-Orient 1900–1901. Récit et notes de voyage, Ceylan, Java, Siam, Indo-Chine, Ile de Haï-nan, Chine, Japon, Corée, Sibérie. Bruxelles: O. Schepens & Cie., 1903. Size 10 × 6½, pp. 446. *Illustrations. Presented by the Author.*

This is a popular account of a visit to Eastern Asia, during which the author kept almost entirely to the beaten tracks, so that additions to our geographical knowledge were not to be expected from it. As regards the general position of affairs in the countries touched at, he shows himself a capable observer, his chief interest being aroused by ethnological questions, and by the various learned institutions at present existing in the far East. The account of Hainan is perhaps the part of the book most worthy of attention.

Eastern Asia. *Sitzb. K.P.A.W. Berlin* (1903): 867–918. **Richthofen.**

Geomorphologische Studien ans Ostasien. IV., V. Von F. von Richthofen.

French Indo-China—Tongking. *Rev. Colon.*, No. 13 (1903): 1–14. **Sangy.**

Notes sur les Mines de cuivre de la Rivière Noire (Tonkin). Par L. de Sangy.

India—Himalayas. **Freshfield.**

Round Kangchenjunga, a Narrative of Mountain Travel and Exploration. By Douglas W. Freshfield. London: Edward Arnold, 1903. Size 10½ × 6½, pp. xvi. and 374. *Maps and Illustrations. Price 18s. net. Presented by the Author.* [See review, *ante*, p. 244.]

India—Railways. **Brereton.**

East India (Railways). Administration Report on the Railways in India for the Calendar Year 1901. By A. Brereton. (Pp. iv. and 396.) Ditto, 1902. By the same. (Pp. iv. and 438.) London: Eyre & Spottiswoode, 1902, 1903. Size 13 × 8½. *Maps and Diagrams. Price 4s. 9d. and 5s. 1d.*

Japan. **Brinkley.**

Japan, its History, Arts, and Literature. By Captain F. Brinkley. Vols. i.—vi. London: T. C. & E. C. Jack, 1903. Size 9½ × 6½, pp. (vol. i.) 260; (vol. ii.) 286; (vol. iii.) 256; (vol. iv.) 268; (vol. v.) 260; (vol. vi.) 302. *Map and Illustrations.*

To be completed in twelve volumes.

Japan. **Chamberlain and Mason.**

A Handbook for Travellers in Japan, including the whole Empire from Yezo to Formosa. By B. H. Chamberlain and W. B. Mason. Seventh Edition. London: John Murray, 1903. Size 7½ × 5, pp. x. and 586. *Maps, Plans, and Illustrations. Presented by the Authors.*

Japan. **Weulersse.**

G. Weulersse. Le Japon d'aujourd'hui, Études sociales. Paris: A. Colin, 1904 [1903]. Size 7½ × 5, pp. x. and 364. *Price 4 fr. Presented by the Publisher.*

Although mainly concerned with the sociological aspects of modern Japan, this work gives, in the opening chapters, an instructive view of the broader features of the country itself, an attempt being made to show how these have reacted on the inhabitants, and helped to make them what they are.

Japan—Formosa. **Yamasaki.**

Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 103–111.

Land und Leute von Taiwan. Von Dr. N. Yamasaki.

Malay Archipelago—Borneo. **Enthoven.**

Bijdragen tot de Geographie von Borneo's Wester-Afdeeling. Door J. J. K. Enthoven. 2 vols. Leiden: E. J. Brill, 1903. Size 10 × 6½, pp. xx. and 922. *Maps. Presented by the K. Nederlandsch Aardrijkskundig Genootschap.* [To be reviewed.]

Malay Archipelago—Sumatra. **Hagen.**

Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 29–85.

Die Gajo-Länder auf Sumatra. Von Dr. B. Hagen. *With Maps and Illustrations.*

Malay Archipelago—Sumatra. **Hagen.**

Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 176–180.

Sumatra und die nördlichen Batakländer. Von Dr. B. Hagen.

Malay Peninsula. **Annandale and Robinson.**

Fasciculi Malayenses. Anthropological and Zoological Results of an Expedition to Perak and the Siamese Malay States, 1901–1902. Undertaken by N. Annandale and H. C. Robinson. Anthropology. Part i. London: Longmans & Co., 1903. Size 10½ × 8, pp. 180. *Illustrations. Price* 15*s. net. Presented by the Publishers.*

This part contains a general description of the Lemangs, Sakais, Trang coast people and Malays of Pérak, with notes on the beliefs and customs of the Patani fishermen observations on physical anthropology, and other subjects.

North-Eastern Asia. **Hawes.**

In the Uttermost East, being an account of investigations among the Natives and Russian Convicts of the Island of Sakhalin, with Notes of Travel in Korea, Siberia, and Manchuria. By Charles H. Hawes. London and New York: Harper & Bros., 1903. Size 9 × 6, pp. xxx. and 478. *Maps and Illustrations. Price* 16*s. Presented by the Publishers.* [To be reviewed.]

Russia—Siberia. *Petermanns M.* **49** (1903): 175–184, 219–227, 255–259. **Enderli.**

Zwei Jahre bei den Tschuktschen und Korjaken. Mitteilung von J. Enderli.

Russia—Siberia. *Petermanns M.* **49** (1903): 184–187. **Friederichsen.**

Prof. W. W. Saposchnikows Reisen im Russischen Altai, 1895 und 1897–99. Von Dr. Max Friederichsen. *With Map.*

Cf. *Journal*, vol. xviii. p. 620.

Russia—Siberia. *Globus* **84** (1903): 64–65. **Krause.**

Die Vegetationsverhältnisse des Lenagebietes. Von E. H. L. Krause.

Russia—Siberia. *Petermanns M.* **49** (1903): 190–191. **Sibiriakow.**

A. E. Nordenskiöld und der Seeweg nach Sibirien. Von A. Sibiriakow.

The author takes stock of the efforts hitherto made to open up commercial intercourse with Northern Siberia.

Russia—Siberia. **Vanderlip and Hulbert.**

In Search of a Siberian Klondike, as narrated by Washington B. Vanderlip, the chief actor, and herein set forth by Homer B. Hulbert. New York: the Century Co., 1903. Size 8½ × 6, pp. xiv. and 316. *Map and Illustrations. Presented by W. B. Vanderlip, Esq.*

On prospecting work in Kamchatka and the extreme east of Siberia.

Siberia. *Petermanns M.* **49** (1903): 174–175. **Hübner.**

Ins Hochland von Liberia. Von Albert Hübner. *With Map.*

Turkey—Asia Minor. **Belck.**

Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 166–170.

Reisen in Pontus und Cappadocien. Von Dr. W. Belck.

Turkey—Asia Minor. *Asien* **2** (1903): 149–153, 172–175, 189–192. **Diest.**

Die Landschaft zwischen Nicæa und Nicomedia. (Erkundung vom Sommer 1900.) Von Oberst W. von Diest. *With Maps.*

AFRICA.

Africa. **Darcy.**

France et Angleterre. Cent Années de Rivalité Coloniale. Par Jean Darcy. l'Afrique. Paris: Perrin et C^ie^, 1904 [1903]. Size 9 × 6, pp. 482.

Abyssinia—Historical. **Beccari.**

Camillo Beccari S.J. Notizia e Saggi di opere e documenti inediti riguardanti la Storia di Etiopia durante i secoli xvi., xvii., e xviii. Roma: Casa Editrice Italiana, 1903. Size 11 × 8, pp. x. and 520. *Maps and Facsimiles. Price* 26*s.* [To be reviewed.]

Azores. *B.S.G. Lisboa* **20** (1902): 359–366. ——

Os Açores. *With Map.*

British East Africa. **Walker.**

Africa. No. 11 (1903). Reports on the Geology of the East Africa Protectorate. By the late E. E. Walker (Government Geologist). London: Eyre & Spottiswoode, 1903. Size 13½ × 8½, pp. 8. *Price* 1½*d.*

Cape Colony. **Gill.**

Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the year 1902. London: Printed by Eyre & Spottiswoode, 1903. Size 12½ × 10, pp. 16.

Egypt—Historical. **Reitemeyer.**

Beschreibung Ägyptens im Mittelalter aus den geographischen Werken der Araber zusammengestellt von Else Reitemeyer. Leipzig: Dr. Seele & Co., 1903. Size 9 × 6, pp. 238.

See note in the December number (vol. xxii. p. 695).

Madagascar. **Grandidier.**

Collection des ouvrages anciens concernant Madagascar. Tome i. Ouvrages ou extraits d'ouvrages portugais, hollandais, anglais, français, allemands, italiens, espagnols et latins relatifs à Madagascar (1500 à 1613). Par MM. A. Grandidier et G. Grandidier. Paris: Comité de Madagascar, 1903. Size 10 × 6½, pp. xvi. and 528. *Maps and Illustrations.* [To be reviewed.]

Morocco—Zaffarines. *A travers le Monde, Tour du Monde* **9** (1903): 309-310. ———

Les Isles Zaffarines. Une nouvelle Station espagnole. *With Map.*

Spain is said to have lately established a coaling-station at these islands, which lie off the north coast of Morocco, east of Melilla.

Natal. **Gray.**

Colony of Natal. Report on the Mining Industry of Natal for the year 1902. By C. J. Gray. Pietermaritzburg, 1903. Size 13 × 8½, pp. 88. *Maps and Sections.*

Nigeria—Benin. **Roth.**

Great Benin, its Customs, Art and Horrors. By H. Ling Roth. Halifax: F. King & Sons, 1903. Size 10½ × 8, pp. xii., 234, and xxxii. *Illustrations. Price* 22*s.* 6*d.* [To be reviewed.]

Rhodesia. *J. African S.* **3** (1903): 53-58. **Melland.**

Mountain and Marsh in Central Africa. (A Short Account of Nature and Sport in N.E. Rhodesia, B.C. Africa, between the Muchinga Mountains and Bangweulu.) By F. H. Melland. *With Maps and Illustrations.*

Rhodesia. ———

The British South Africa Company. Official Handbook of North-Eastern Rhodesia. April, 1903. Fort Jameson. Size 9½ × 6, pp. 28. *Map. Presented by the Administrator.*

Somaliland. *B.S.G. Italiana* **4** (1903): 532-560. **Mori.**

L'azione coloniale dell' Italia nella Somalia. Il periodo delle esplorazioni. Nota del Dott. A. Mori.

South Africa. *Contemporary Rev.* **84** (1903): 635-655. **Fawcett.**

Impressions of South Africa in 1901 and in 1903. By M. G. Fawcett.

South-East Africa. **Findlay.**

Big Game Shooting and Travel in South-East Africa. An Account of Shooting Trips in the Cheringoma and Gorongoza Divisions of Portuguese South-East Africa and in Zululand. By F. R. N. Findlay. With Chapters by Olive Schreiner and S. C. Cronwright-Schriener. London: T. Fisher Unwin, 1903. Size 9½ × 6, pp. xii. and 314. *Map and Illustrations. Price* 15*s. net. Two copies; one presented by the Author, the other by the Publisher.*

[See review, *ante*, p. 248.]

Uganda. *P. Zoolog. S.* (1903, vol. i.): 2-10. **Budgett.**

Account of a recent journey to Uganda in search of the Okapi and *Polypterus.* By J. S. Budgett.

West Africa. **Hayford.**

West Africa and Christianity. A lecture delivered at the Rochester Theological Seminary, New York, U.S.A., September 28, 1900, by Rev. Mark C. Hayford, D.D. London: Baptist Tract & Book Society. Size 8½ × 5½, pp. 68. *Map. Presented by the Author.*

The writer, himself an African by race, discusses various controversial questions connected with the attempt to Christianize the Negroes.

West Africa—Boundary. *Rev. Colon.* No. 13 (1903): 15–49. **Duboc.**

Mission de délimitation du Golfe de Guinée. (Historique, journal de route.) Par le lieutenant Duboc.

NORTH AMERICA.

Alaska. **Cane.**

Summer and Fall in Western Alaska: the Record of a Trip to Cook's Inlet after Big Game. By Colonel Claude Cane. London: Horace Cox, 1903. Size 9 × 6, pp. viii. and 192. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Mainly devoted to sporting adventures; but the descriptions and illustrations give a good idea of the physical character of the country, and its present stage of development.

Alaska—Wrangell Mountains. *National G. Mag.* 14 (1903): 395–407. **Mendenhall.**

The Wrangell Mountains, Alaska. By W. C. Mendenhall. *With Illustrations.*

Canada. **Bradley.**

Canada in the Twentieth Century. By A. G. Bradley. London: A. Constable & Co., 1903. Size 9 × 6, pp. xii. and 428. *Map and Illustrations. Price* 16*s. net. Presented by the Publishers.*

Useful as supplying a general picture of Canada and Canadian life, the need for which has often been felt.

United States—Historical. **Carpenter.**

The American Advance, a Study in Territorial Expansion. By E. J. Carpenter. London and New York: John Lane, 1903. Size 9 × 6, pp. x. and 332. *Map. Price* 10*s.* 6*d. net. Presented by the Publisher.*

An instructive sketch of the territorial expansion of the United States from the Declaration of Independence to the present time.

United States—Hydrology. **Newell.**

Report of Progress of Stream Measurements for the Calendar Year 1901. By F. H. Newell. (Water-Supply Paper, No. 75, U.S. Geol. Survey.) Washington, 1903. Size 9½ × 6, pp. 246. *Maps and Illustrations. Presented by the Geol. Survey.*

United States—Hydrology. **Pressey.**

Observations on the Flow of Rivers in the vicinity of New York City. By H. A. Pressey. (Water-Supply Paper, No. 76, U.S. Geol. Survey.) Washington, 1903. Size 9½ × 6, pp. 108. *Diagrams and Illustrations. Presented by the Geol. Survey.*

United States—Hydrology.

Operations at River Stations, 1901. Parts i. and ii. (Water-Supply Papers, Nos. 65 and 66, U.S. Geol. Survey.) Washington, 1902. Size 9½ × 6, pp. (No. 65) 334; (No. 66) 188. *Presented by the U.S. Geological Survey.*

Contains a large number of data on river levels, discharges, etc.

United States—Idaho and Oregon. **Russell.**

Preliminary Report on Artesian Basins in South-western Idaho and South-eastern Oregon. By I. C. Russell. (Water-Supply Paper, No. 78, U.S. Geol. Survey.) Washington, 1903. Size 9½ × 6, pp. 52. *Maps. Presented by the Geol. Survey.*

United States—Massachusetts. **Perry and Emerson.**

The Geology of Worcester, Massachusetts. By J. H. Perry and B. K. Emerson. Worcester Natural History Society, 1903. Size 9½ × 6½, pp. xii. and 166. *Map and Illustrations. Presented by the Worcester Natural History Society.*

United States—Massachusetts. *J. Geology* 11 (1903): 323–364. **Taylor.**

The Correlation and Reconstruction of Recessional Ice Borders in Berkshire County, Massachusetts. By F. B. Taylor. *With Maps and Illustrations.*

United States—Mississippi. *J. Franklin I.* 156 (1903): 241–260. **Haupt.**

Controlling the Floods of the Mississippi River. By Prof. L. M. Haupt. *With Maps and Illustrations.*

United States—New Hampshire. *J. Geology* 11 (1903): 403–412. **Perry.**

Notes on the Geology of Mount Kearsarge, New Hampshire. By J. H. Perry. *With Illustrations.*

United States—Texas. **Taylor.**

Irrigation Systems of Texas. By T. U. Taylor. (Water-Supply Paper, No. 71, U.S. Geol. Survey.) Washington, 1902. Size 9½ × 6, pp. 138. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Wyoming and Nebraska. **Adams.**

Geology and Water Resources of the Patrick and Goshen Hole Quadrangles in Eastern Wyoming and Western Nebraska. By G. I. Adams. (Water-Supply Paper, No. 70, U.S. Geol. Survey.) Washington, 1902. Size 9½ × 6, pp. 50. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *T. and P.G.S. Pacific* **2** (1903): 1–64. **Corthell.**

Two Years in Argentina as the Consulting Engineer of National Public Works. By E. L. Corthell. *With Illustrations.*

Brazil. **Katzer.**

Grundzüge der Geologie des unteren Amazonasgebietes (des Staates Pará in Brasilien). Von Dr. F. Katzer. Leipzig: M. Weg, 1903. Size 10½ × 7, pp. 296. *Map and Illustrations. Price* 19*s.*

Ecuador. *Z. Ges. Erdk. Berlin* (1903): 527–530. **Meyer.**

Ueber meine Ecuador-Reise. Von Prof. Dr. H. Meyer.

See note in the December *Journal* (p. 701).

Martinique—Mont Pelée. *Science* **18** (1903): 184–185. **Heilprin.**

The Ascending Obelisk of the Montagne Pelée. By Prof. A. Heilprin.

Martinique and St. Vincent. *Tour du Monde* **9** (1903): 433–456. **Verschuur.**

Aux Pays devastés: La Martinique et Saint-Vincent. Par G. Verschuur. *With Maps and Illustrations.*

Patagonia. *C. Rd.* **137** (1903): 348–349. **Tournouër.**

Coupes des terrains tertiaires de la Patagonie. Note de A. Tournouër.

South America—Ethnology. **Saavedra.**

Estudios sociológicos. El Ayllu. Por Bautista Saavedra. La Paz, 1903. Size 7 × 4, pp. 212. *Presented by the Oficina Nacional de Immigracion, etc., La Paz.*

South America—Ferns. *Arkiv. Botanik* **1** (1903): 187–275. **Lindman.**

Beiträge zur Kenntnis der tropischamerikanischen Farnflora. Von C. A. M. Lindman. *With Plates.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Gibbs.**

Australasia: the Britains of the South. By P. H. Gibbs. London: Cassell & Co., 1903. Size 7 × 5, pp. vi. and 196. *Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

One of a series ("Our Empire Series") which will be useful to the general reader as supplying a concise outline of the growth and development of the principal units of the British Empire.

Australasia—Discovery. **Calvert.**

The Discovery of Australia. By Albert F. Calvert. Second Edition. London: Dean & Son, 1902. Size 10 × 7½, pp. xii. and 184. *Maps and Illustrations. Presented by the Author.*

In this edition the bulk of the work has been nearly doubled, and the reproductions of old maps largely added to. These form the most useful feature, as in some cases they have not yet been made widely accessible, though the smallness of the scale is a drawback. In many of his conclusions the author shows a want of critical judgment, and misprints are of not unfrequent occurrence.

New South Wales—Mount Lindsay. **Andrews.**

Records Geol. Surv. New South Wales **7** (1903): 238–240.

A Preliminary Note on the Structure of Mount Lindsay. By E. C. Andrews. *With Illustration.*

Tasmania. *P.R.S. Victoria* **16** (1903): 177–183. **Gregory.**

Some Features in the Geography of North-Western Tasmania. By Dr. J. W. Gregory. *With Map and Plate.*

Victoria. *P.R.S. Victoria* **16** (1903): 154–176. **Kitson.**

Volcanic Necks at Anderson's Inlet, South Gippsland, Victoria. By A. E. Kitson. *With Maps and Sections.*

Victoria—Mitchell River. *P.R.S. Victoria* **16** (1903): 12–47. **Dennant and Clark.**
Geology of the Valley of the Lower Mitchell River. By J. Dennant and D. Clark. *With Map and Sections.*

POLAR REGIONS.

Antarctic—Scottish Expedition. *Scottish G. Mag.* **19** (1903): 589–595. ——
Scottish National Antarctic Expedition.

Arctic—Bear Island. **Nathorst.**
K. Svensk. Vet.-A. Handlingar **36** (1902–1903): No. 3, pp. 60.
Zur oberdevonischen Flora der Bären-Insel. Von A. G. Nathorst. *With Plates.*

Arctic—Eskimo. **Faustini.**
A. Faustini, L'Esodo Eschimese (Un capitolo di antropogeografia artica). (Estratto dalla *Rivista di Fisica, Matem., e Scienze nat. (Pavia).* Anno IV.—Giugno 1903—Numero 42.) Pavia, 1903. Size 9½ × 7, pp. 28. *Map. Presented by the Author.*

Arctic—Zoology. **Kolthoff.**
K. Svensk. Vet.-A. Handlingar **36** (1902–1903): No. 9, pp. 104.
Bidrag till Kännedom om norra polar-trakternas däggdjur och fåglar. Af G. Kolthoff.
On Arctic mammals and birds.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geological Botany. *Nature* **68** (1903): 556–568. **Seward.**
The British Association. Section K. Botany. Opening Address by A. C. Seward, F.R.S. *With Maps.*
On 'Floras of the Past: their Composition and Distribution.'

Hydrology. **Slichter.**
The Motions of Underground Waters. By C. S. Slichter. (Water-Supply Paper. No. 67, U.S. Geol. Survey.) Washington, 1902. Size 9½ × 6, pp. 106. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

Meteorology—Dust-falls. *Globus* **84** (1903): 181–184. **Krebs.**
Staubfälle, Blutregen, Blutschnee. Von W. Krebs.

Meteorology—Dust-fall. *Naturw. Wochenschrift* **2** (1903): 603–605. **Walther.**
Der grosse Staubfalle von 1901 und das Lössproblem. Von Prof. J. Walther. *With Map.*

Oceanography—North Atlantic Ocean. **Lehmann.**
Sitzb. K.P.A.W. Berlin (1903): 560–583.
Untersuchungen über die Tier- und Pflanzenwelt sowie über die Bodensedimente des Nordatlantischen Ozeans zwischen dem 38. und 50. Grade nördl. Breite. Von Dr. H. Lohmann. *With Diagram.*

Sea-level. *C. Rd.* **137** (1903): 222–224. **Négris.**
Observations concernant les variations du niveau de la mer depuis les temps historiques et préhistoriques. Note de P. Négris.

Volcanoes. *Sitzb. K.P.A.W. Berlin* (1903): 748–756. **Branco.**
Die Gries-Breccien des Vorrieses als von Spalten unabhängige, früheste Stadien embryonaler Vulcanbildung. Von W. Branco.

Volcanoes. *Sitzb. K.P.A.W. Berlin* (1903): 757–778. **Branco.**
Zur Spaltenfrage der Vulcane. Von W. Branco.

Zoo-geography—Domestic animals. **Müller.**
Die geographische Verbreitung der Wirtschaftstiere mit besonderer Berücksichtigung der Tropenländer. Von Dr. Robert Müller. (Studien und Beiträge zur Geographie der Wirtschaftstiere, Erster Band.) Leipzig. M. Heinsius Nachfolger. 1903. Size 9 × 6, pp. viii. and 296. *Illustrations. Price* 8*s.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical. **Vignaud.**
La Route des Indes et les indications que Toscanelli aurait fournies à Colomb. Lettre au Dr. Jules Mees, qui pourra intéresser le Dr. Sophus Ruge. Par Henry

Vignaud. Paris: E. Leroux, 1903. Size 10 × 6½, pp. 36. *Presented by the Author.*

A further reply to criticisms of M. Vignaud's theory, without, however, presenting anything likely to convince the champions of the orthodox view.

Historical—Carpini and Rubruquis. **Beazley.**

The Texts and Versions of John de Plano Carpini and William de Rubruquis as printed for the First Time by Hakluyt in 1598, together with some shorter pieces. Edited by C. R. Beazley. London: Printed for the Hakluyt Society, 1903. Size 9 × 6, pp. xx. and 346.

See review in *Geographical Journal*, vol. xxii. p. 556.

Historical—Early Voyages. **Hakluyt.**

The Principal Navigations Voyages Traffiques and Discoveries of the English Nation made by Sea or Over-land to the Remote and Farthest Distant Quarters of the Earth at any time within the compasse of these 1600 yeeres. By Richard Hakluyt. Vols. i. and ii. Glasgow: James MacLehose, 1903. Size 9 × 6, pp. (vol. i.) lxxx. and 356; (vol. ii.) xii. and 488. *Facsimile Maps and Portraits. Price* 12*s.* 6*d. net per volume. Presented by the Publishers.*

This fine edition will be completed in twelve volumes.

History. **Souttar.**

A Short History of Ancient Peoples. By Robinson Souttar. With an Introduction by the Rev. A. H. Sayce. London: Hodder and Stoughton, 1903. Size 10 × 6½, pp. xxiv. and 728. *Maps. Price* 12*s. Presented by the Publishers.*

This work will be useful to the general reader, as presenting an outline of our knowledge of the ancient empires of the East and the Mediterranean as enlarged by recent researches. It is too much a mere summary to be of much use to serious students, for whom it is evidently not intended.

Man and the Ocean. **Kirchoff.**

The Sea in the Life of the Nations. By Alfred Kirchoff. (From the Smithsonian Report for 1901, pages 389–399.) Washington, 1902. Size 10 × 6½. *Presented by the Author.*

Translated from the *Geographische Zeitschrift*, 1901.

GENERAL.

Exploration. **Höfler.**

Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 117–129.

Einiges aus den Forschungen der letzten Jahre zur Erweiterung der Kenntnis der Erdoberfläche: Nordpolargebiet, Amerika, Australisches Festland, Afrika. Von Prof. Dr. F. Höfler.

Geography. **Krümmel.**

Ausgewählte Stücke aus den Klassikern der Geographie für den Gebrauch an Hochschulen zusammengestellt von O. Krümmel. Erste Riehe. Aus A. v. Humboldt, Carl Ritter, Oscar Peschel und E. v. Sydow. Kiel und Leipzig: Lipsius & Tischer, 1904 [1903]. Size 9½ × 6½, pp. vi. and 174. *Presented by the Editor.*

Geography in Education. **Gruber.**

Geographie als Bildungsfach. Von Dr. C. Gruber. Leipzig: B. G. Teubner, 1904 [1903]. Size 9½ × 6½, pp. xvi. and 156.

Hints to Travellers—Outfit. **Harford.**

Hints on Outfit for Travellers in Tropical Countries, by Dr. C. T. Harford. London: Royal Geographical Society, 1903. Size 7 × 5, pp. 60. *Price* 1*s.* 3*d. net.*

This is an enlarged and entirely rewritten edition of the hints on outfit formerly included in the Society's 'Hints to Travellers.'

Malaria. *B.S.G. Italiana* **4** (1903): 627–633. **Pittaluga.**

Per le carte della distribuzione geografica della malaria. Nota del Dott. G. Pittaluga.

Medical Geography—Sleeping Sickness. *J. African S.* **3** (1903): 1–11. **Christy.**

Sleeping Sickness. By Dr. C. Christy. *With Illustrations.*

Orthography. *Ann. Hydrographie* **31** (1903): 377–378. ——

Neue Grundsätze für die Schreibweise geographischer Namen.

Noticed in Monthly Record, *ante*. See also *Deuts. Kolonialblatt* (1903).

Travel. **De Windt.**

From Paris to New York by Land. By Harry de Windt. London: George Newnes, 1904 [1903]. Size 9 × 6, pp. xiv. and 312. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

[See review, *ante*, p. 246.]

Travel. **Gerard.**

Leaves from the Diaries of a Soldier and Sportsman during twenty years' service in India, Afghanistan, Egypt, and other Countries, 1865–1885. By Lieut.-General Sir Montagu Gilbert Gerard, K.C.B., etc. London: John Murray, 1903. Size 9 × 6, pp. 400. *Illustrations. Price* 15*s. net. Presented by the Publisher.*

This book abounds with interesting reminiscences of the events in which the author took part in the course of his varied experience of military duty. The bulk refers to India, especially Central India, but Abyssinia, Afghanistan, and Egypt all come within the writer's field. There are many interesting particulars on the wild beasts of the countries dealt with, and their ways.

Water. **De la Coux.**

Industrial Uses of Water. By H. De la Coux. Translated from the French and Revised by Arthur Morris. London: Scott, Greenwood & Co., 1903. Size 10 × 6¼, pp. viii. and 354. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Deals almost entirely with the chemical composition of natural waters, means of purification, and the like. The question of water-supply is not touched upon.

Water. **Pollock.**

Light and Water, a Study of Reflexion and Colour in River, Lake, and Sea. By Sir Montagu Pollock, Bart. London: G. Bell & Sons, 1903. Size 9½ × 7, pp. xii. and 116. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

An interesting study of the optical principles involved in the phenomena of reflection and colour in water. Although written primarily from an artistic point of view, much of the subject-matter, especially that relating to colour, is of interest to geographers, from the important part played by water in the physical aspect of a country. The principles involved are, for instance, of importance in discussing the black water of some rivers.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Eisenbahn- und Postkarte von Oesterreich-Ungaru. Vierte Neubearbeitung. 4 Auflage. Scale 1:1,500,000 or 23·6 stat. miles to an inch. Vienna: Artaria & Co., 1904. *Price* 2.20*k. Presented by the Publishers.*

British Isles. **Bartholomew.**

The Handy Touring Atlas of the British Isles, specially prepared for Cyclists, Motorists, and Travellers. By J. G. Bartholomew, F.R.G.S. London: George Newnes, Limited, [1903]. *Price* 1*s. Presented by J. G. Bartholomew, Esq.*

A handy little pocket atlas of the British Isles, specially prepared for the use of tourists. The maps, on the scale of 8 miles to an inch, have been reduced by permission from the Ordnance Survey, and coloured orographically in Bartholomew's well-known clear manner. In addition, there are small general railway and road maps, a plan of the environs of London, and a table of cycling routes, with distances and vertical sections.

East Prussia. **Braun.**

Der Okull- und Kort-see (Kreis Allenstein). Nach eigenen Lotungen, gezeichnet auf Grund der Messtischblätter von Dr. G. Braun, 1903. Scale 1:2,500 or 0·39 stat. mile to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1903, Tafel 23. Gotha: Justus Perthes. *Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1903.

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Printed in colours, 55, 56, 63, 64, 65, 68, 74, 77, 94, 1*s. each;* folded in covers or flat in sheets.

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Cambridgeshire, 59 N.W., S.W., S.E., 62*b* S.W., 63 N.W. **Dorsetshire,** 19 N.E., S.E., 28 N.E., 29 N.E. **Gloucestershire,** 23 S.E., 24 N.E., 31 S.W., 47 N.E., 64 N.E., 65 N.E., 68 S.W., 69 S.W. **Herefordshire,** 1 S.E., 5 N.E. **Leicestershire,** 4 S.E., 5 N.W., S.E., 9 S.W., 10 N.E., 11 N.E., 12 N.W., 15 N.E., S.W., 22 N.W., S.W., 23 N.E., 30 N.W. **Radnorshire,** 4 S.W., 18 N.E. **Shropshire,** 70 S.E., 72 S.E., 79 N.W., 80 N.W. **Somersetshire,** 10 N.W., 11 N.W., 34 N.W., S.W., 45 N.E., 46 N.W., N.E., S.W., 92 N.E., S.E. **Staffordshire,** 55 S.W., 61 S.W., 63 S.E. **Wiltshire,** 7 N.E. **Worcestershire,** 8 S.W., 13 S.W., 14 N.W. 1*s. each.*

25-inch—County Maps (first revision):—

Brecknockshire, V. 1, 14. **Gloucestershire,** XXXIV. 13; XXXIX. 14; LXXI. 1, 2, 3, 4, 5, 7, 11, 12. **Herefordshire,** VI. 13, 16; VII. 14, 15, 16; X. 10, 14, 15; XI. 8, 12, 13, 14, 15; XII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; XIII. 1, 9; XIV. 9; XVII. 1, 2, 4, 6, 7, 9, 10, 12; XXIV. 11; XXX. 4; XXXI. 1, 5, 7, 10. **Leicestershire,** XII. 10, 14, 15; XVII. 8, 16; XVIII. 10, 13, 14; XIX. 13; XXIV. 4, 8; XXV. 2, 3, 5, 8, 10, 12; XXVI. 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 15; XXX. 4, 8; XXXI. 1, 2, 3; XXXII. 6, 8; XLII. 16; XLV. 9. **Radnorshire,** IX. 10, 16; XI. 9, 14, 15; XV. 14, 16; XVI. 13, 14, 16; XXII. 1, 8; XXIII. 3; XXIV. 1, 5, 9, 13, 15, 16; XXV. 10, 13, 14; XXIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12; XXX. 1, 2, 9; XXXVI. 4; XXXVII. 1. **Shropshire,** LXXVI. 9, 14, 15; LXXX. (10 and 11). **Somersetshire,** II. 7, 11, 12, 15, 16; III. 13; IV. 7; VI. 1, 5, 15, 16; VIII. 12, 16; XIV. 15; XVI. 10; XIX. 1, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXI. 9, 10, 13; XXV. 15; XXVI. 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; XXVII. 9, 10, 11, 12, 13, 14, 15, 16; XXVIII. 4, 15; XXX. 1, 2, 3, 5, 6, 7; XXXI. 1, 5; XXXIX. 1, 2, 3, 5, 8; XL. 1, 2, 3, 4, 5, 6, 7, 8; XLI. 1, 3, 4, 5, 6, 9, 11, 12, 13, 14, 15; XLII. 9, 11, 13, 15, 16; XLIII. 2, 3, 7, 13, 14, 15; XLIV. 3, 12; XLVI. 11, 12, 15, 16; LIV. 7, 8, 9, 13, 14, 15; LV. 1, 2, 3; LVI. 7; LVII. 1, 2; LXIII. 5; LXV. 1, 14, 15; LXXIII. 9, 10, 14, 15; LXXIV. 1; LXXX. 2; LXXXII. 11; LXXXVIII. 2; LXXXIX. 5, 11, 14; XCI. 8. **Staffordshire,** LXVIII. 2, 4; LXIX. 1, 2. **Suffolk,** LXXIII. 5, 6, 7, 9, 10, 11, 12, 13, 15, 16; LXXVI. 9; LXXXIV. 1, 2, 5; LXXXVII. 3, 4. **Warwickshire,** VIII. 2, 3, 8, 12; IX. 9; X. 13, 14; XI. 13, 14, 16; XV. 2, 4; XVI. 1, 2, 5, 10, 11, 12; XVII. 4, 6, 7, 8, 9, 10, 11, 12; XVIII. 5, 9. **Worcestershire,** XX. 15, 16; XXI. 13; XXII, 15, 16; XXVII. 2, 3, 4, 7, 8, 12; XXVIII. 1, 5, 7, 8, 9, 12; XXIX. 3, 4, 5, 9. **Yorkshire** (first revision of 1891 survey), CCLXXXIV. 4, 8. 3*s. each.*

(*E. Stanford, London Agent.*)

ASIA.

Burma. **Petermanns Geographische Mitteilungen.**

Britisch-Birma nach den neuesten Grenzbestimungen auf Grund amtlicher Quellen. Scale 1:6,000,000 or 96·46 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1903, Tafel 24. Gotha: Justus Perthes. *Presented by the Publishers.*

China. **China League.**

A Commercial map of China and its dependencies, showing the areas owned or leased by Foreign Powers. Issued by the China League. Scale 1:7,603,200 or 120 stat. miles to an inch. London: Edward Stanford, 1903. *Price* 2*s.* 6*d.*

A general outline map of the Chinese empire and portions of adjacent countries,

without hill-work, showing in red railways opened and proposed, the extent of the navigability of rivers, and treaty ports and other information connected with the commercial development of South-Eastern Asia. By different tints, an attempt has been made to indicate the various territorial possessions and those parts of the Chinese empire that have been leased to European countries, or over which these powers exercise a dominating influence. Although extremely general in character, this map ought to be interesting at the present time.

Indo-China. **Pavie.**

Mission Pavie. Indo-Chine. Atlas. Notices et Cartes par Auguste Pavie. Paris: Augustin Challamel, 1903. *Price* 7.50 *fr.*

With the appearance of this atlas the publication of the results of the Pavie Mission in Indo-China is complete. The atlas contains ten maps and letterpress describing the geography of the region.

Siberia. **Stanford.**

Map of the Siberian Railway, the great land route to China and Korea. Scale 1: 6,969,600 or 110 stat. miles to an inch. London: Edward Stanford, 1903. *Price* 10*s.* 6*d.* *Presented by the Publisher.*

The foundation of this map is Stanford's library map of Asia. Both the Siberian and Trans-Caspian railways are shown, and it includes Asiatic and the greater part of European Russia, Northern China, Korea, and Japan.

Sikhim. **Garwood.**

Material for a Geological Map of Sikhim. By Prof. E. J. Garwood. Scale 1: 253,440 or 4 stat. miles to an inch. London: Edward Arnold, 1903.

Prof. E. J. Garwood accompanied Mr. D. W. Freshfield on his recent expedition in Sikhim and Eastern Nepal, and the present map is the outcome of the geological data collected by him upon this journey, collated with the very meagre information to be obtained from other sources. It is evident that no opportunity was lost upon the journey for collecting information, and considering how short a time he was in the country, and the unfavourable weather experienced for a great part of that time, it is surprising that Prof. Garwood has been able to produce even a sketch-map of the geology of this region. He has very wisely not attempted anything more than a preliminary sketch, and instead of a series of colour tinting, which, with the little that is at present known, could only be erroneous and misleading, he has merely given notes in red lettering concerning the geology upon a clearly drawn outline map of the country. This will prevent confusion in the future, and is a good expample which might with advantage be followed by others. The map only shows what is actually known, but it will form a good basis for others later on. It has been specially prepared to accompany Mr. Freshfield's recently published account of his expedition.

AFRICA.

Africa. **Bartholomew.**

Political Map of Africa. By J. G. Bartholomew, F.R.G.S. Scale 1: 12,000,000 or 189·3 stat. miles to an inch. New Edition. Edinburgh: John Bartholomew & Co., 1903. *Price* 2*s. mounted on cloth. Presented by the Publishers.*

A new edition of this useful and well-known general map of Africa.

Egypt. **Egyptian Survey Department.**

Topographical Map of Gharbia Province. Scale 1: 10,000 or 0·15 stat. mile to an inch. Sheet No. 31–2 N.E. Revised in 1903. Cairo: Public Works Department, Survey Department. *Presented by Captain H. J. Lyons, Director-General, Survey Department, Cairo.*

Orange River Colony. **Duncan.**

Divisional Maps of the Orange River Colony. Scale 1: 148,705 or 2·3 stat. miles to an inch. Compiled by A. H. Duncan for the Orange River Colony Surveyor-General's Office, Bloemfontein. Sheets: Klerksdorp, Potchefstroom, Bloemhof, Bothaville, Frankfort, Vrede, Kimberley, N.E. and S.E., Boshof, Brandfort, Senekal, Bethlehem, Harrismith, Fauresmith, Ladybrand, Philipstown, Philippolis, Smithfield, Jacobsdal, Zastron. Bloemfontein and London: Argus Printing and Publishing Co., 1902. *Price* 7*s.* 6*d. each sheet. Presented by the Surveyor-General of the Orange River Colony.*

Since this series was noticed in the *Geographical Journal* in December last, the Society has, through the kindness of the Surveyor-General of the Orange River Colony, been presented with a complete set of the maps, which will prove most useful for reference in the Map Room.

Somaliland. **Blair.**

Map of the Nogal Valley and a part of the Haud Somaliland. Scale 1 : 475,200 or 7·5 stat. miles to an inch. From a compilation by Captain R. W. C. Blair, I.A. Simla: Intelligence Branch, 1903. *Presented by the Assistant Quarter-Master-General, Intelligence Branch, Simla.*

AMERICA.

Canada. **Department of the Interior, Canada.**

Maps of Alberta and western portions of Saskatchewan and Assiniboia; Assiniboia; and Saskatchewan. Scale 1: 792,000 or 12·5 stat. miles to an inch. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Three large coloured sheets with names and outlines of land districts printed in red. Land offices are shown by a red circle.

Rocky Mountains. **Department of the Interior, Ottawa.**

Topographical Map of the Rocky Mountains. Scale 1 : 126,720 or 2 stat. miles to an inch. Banff and Lake Louise Sheets. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

These sheets show the country adjacent to the Canadian Pacific railway from Kananaskis on the east to Palliser on the west, and this pass over the Rocky mountains, and include Banff and the Kicking Horse pass. Relief is shown by contours in brown at intervals of 250 feet, and water in blue. They are most credible productions, and the contouring is well drawn.

AUSTRALASIA.

Western Australia. **Maitland and Campbell.**

Geological Map of the Boulder Belt, East Coolgardie Goldfield. By A. Gibb Maitland, Government Geologist, and W. D. Campbell, Assistant Geologist. Scale 1 : 7488 or 624 feet to an inch. 3 sheets. Perth, W.A.: Geological Survey Office, 1903. *Presented by the Government Geologist of Western Australia.*

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abteilung des Auswärtiger Amts. Lieferung 3. Deutsch-Ostafrika. Scale 1: 1,000,000 or 13·7 stat. miles to an inch. Sheets: 21, Daressalam; 24, Lindi. Die deutschen Besitzungen im Stillen Ocean und Kiautschou. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Sheet 29, Karolinen. Berlin: Dietrich Reimer (Ernst Vohsen), 1903. *Price* 3*m.* *Presented by the Publisher.*

World. **Bartholomew.**

The Advanced Atlas for South African Schools. A new series of 130 Physical, Political, and Commercial Maps, with lessons on Map Reading and Statistics. By J. G. Bartholomew, F.R.G.S. Cape Town: J. C. Juta & Co.; London: Thomas Nelson & Sons. *Presented by the Superintendent-General of Education, Cape Town.*

This atlas may be considered an extended and more advanced edition of the 'Atlas for South African Schools,' issued some time ago, and, like that, has been published under the auspices and at the special desire of the Superintendent-General of Education for Cape Colony. Although all parts of the world are dealt with, special attention has naturally been given to South Africa. Many of the maps will be familiar to those acquainted with Messrs. Bartholomew's atlases, but the selection here has been carefully made for the special purpose in view.

World. **Petri and Schokalsky.**

Marcks' Large General Table Atlas. Edited by Prof. E. J. Petri and Colonel J. de Schokalsky. Parts 1 and 2. St. Petersburg: A. F. Marcks. 1904. [In Russian.] *Presented by the Publisher.*

The above are the first two parts of a new Russian atlas now being published by M. A. F. Marcks of St. Petersburg, and which, when complete, will consist altogether of sixty parts. The maps of the Russian Empire, nineteen in number, are entirely new; but the plates of the well-known atlas published by Wagner & Debes, of Leipzig, will form the basis of most of the others. These, however, are to be carefully revised and brought up to date. The preparation of the maps is in the hands of Prof. E. J. Petri and Colonel J. de Schokalsky, who are evidently carrying out the work in a most satisfactory manner. As in Debes' atlas, the maps are printed in

colours; and on all of them the depths of the water adjacent to the coast-line is shown by different tints of blue. Part i. contains a general physical map of the world showing heights and depths, two sheets of a new map of European Russia on the scale of 1 : 2,000,000, drawn by Colonel Schokalsky, and small-scale general maps of France and the Balkan peninsula, whilst in part 2 will be found two more sheets of the map of European Russia and general maps of Asia, Eastern Asia, and Central America.

World. **Schrader.**

L'Année Cartographique Supplément annuel à toutes les publications de Géographie et de Cartographie Dressé et rédigé sous la direction de F. Schrader. Treizième supplément contenant les modifications géographiques et politiques des années 1900-1902. Paris: Hachette et Cie. 1903. *Price* 3 *fr.*

The above is the thirteenth issue of this interesting annual, and contains a *résumé*, accompanied by maps, of the more important expeditions and geographical work undertaken in the year 1902, the results of which have been published during the past year. There are three sheets of maps altogether, the first being devoted to Asia and the South Pole, the second to Africa, and the third to America. On the first sheet there are maps showing the results of the British National Antarctic Expedition, Dr. Sven Hedin's explorations in Central Asia, and a hypsometrical map of Indo-China. The next deals with Africa, and contains altogether ten maps and insets, the principal of which are a map of French Congo from recent surveys, the Bahr el Ghazel region from surveys of the Marchand expedition, recent exploration work of French officers in the Sahara, the Sudan-Abyssinia boundary, and the route of the Bourg de Bozas expedition from Addis Ababa to the Nile. The America sheet contains a sketch-map of Captain Sverdrup's explorations in Arctic America, maps of the newly defined Argentine-Chile and Alaskan boundaries, and maps illustrative of the volcanic eruptions in the West Indies. Upon the back of each map M. Schrader has given a short account of the various expeditions.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for January, 1904. London: Meteorological Office. *Price* 6d. *Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for December, 1903, and of the North Pacific Ocean for January, 1904. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

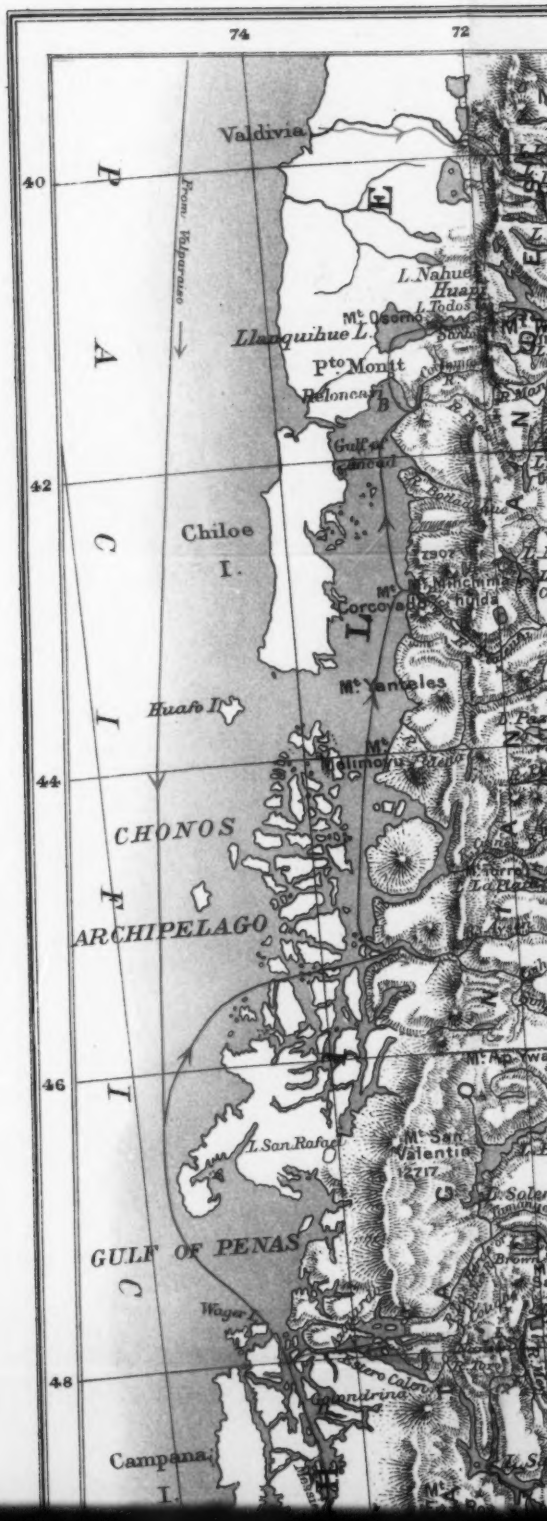
Nigeria.

Forty-six Photographs of Northern Nigeria. *Presented by Brigadier-General Sir Frederick Lugard,* K.C.M.G., C.B., D.S.O.

As will be gathered from the titles, several of these photographs are of special interest in connection with the occupation of Northern Nigeria, and in time to come their historical importance will have increased. A selection of them were shown as lantern slides when Sir F. Lugard read his paper before the Society in November last.

(1 and 2) Troops on review at the proclamation of the transfer of Nigeria; (3) Guard of honour; (4) Weaving cloth; (5) Niger Company's wharf at Lokoja; (6) Interior of native Emir's palace; (7) Making fast a canoe; (8) Borgu hunters; (9) Bee rock, Jebba; (10) Design on house; (11 and 12) Interview with Emir; (13) *Corona*, High Commissioner's yacht; (14) Ceiling of the Emir of Kano's audience chamber; (15) A Kano gate; (16) View inside Zaria; (17) Wall of Emir of Zaria's compound; (18) The Emir of Kano's palace; (19) Exterior of the Emir of Kano's harem; (20) View of Kano from the Dallah hill; (21) Gate at Kano through which the storming party entered; (23) The Resident's cattle, Zaria; (24) The Residency mess, Zaria.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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Valdivia
From Valparaiso
L. Nahuel Huapi
L. Todos los Santos
Mt. Osorno
Llanquihue L.
Pto Montt
Peloncavi B.
Gulf of Ancud
Chiloe I.
Corcovado
Mt. Yantales
Huafo I.
Melimoyu
CHONOS ARCHIPELAGO
L. San Rafael
Mt. San Valentin 12717
GULF OF PENAS
Wager I.
Campana I.
CHILE
PACIFIC OCEAN

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Mt. Lanin 12382
L. Huechu Lafquen
Junin de los Andes
Confluencia
Huincul Mapu
TERRITORY OF
L. Lacar
L. Traful
R. Limay
R. Neuquen
Mt. Trolhador
Mt. Moscardi
RIO NEGRO
Maquinchao
Los Tres Hermanas
L. Pitelo
Cholilo
R. Chubut
L. Menendez
L. Epalafquen
Colonie 16 de Octubre
R. Tecka
Pampa de Gajan
TERRITORY OF
Paso de Indios
Colonie G.e S. Martin
CHUBUT
L. Fontana
R. Senguerr
Stanley
L. Colhue
L. Musters
Colonie Sarmiento
R. Mayo
Koslbuski
R. Desire
L. Buenos Aires
Soler
L. Rueyrredon
TERRITORY
L. Belgrano
L. San Martin
L. Cardiel
R. Chico
I. Choel-choel
R. Colorado
Rio Negro
Port San Antonio
Colonie Balcheta
R. Balcheta
Viedma
Patagones
Tamuster
GULF OF SAN MATIAS
To Bahia Blanca
From Bahia Blanca
San Jose B.
Pto Madryn
Cracker
(Welsh settlement)
Trelew
Rawson
Gaiman
R. Chubut
To Bahia Blanca
Mt Tristo
Camarones Bay
L.o Grande
ATLANTIC
Rada Tilly
GULF OF St GEORGE
Rivadavia
Port Desire
OCEAN

48
Campana
I.
Hanover
I.
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ST OF MAGELLAN
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Published by the Royal Geographical Society.

OROGRAPHICA

P. KR

Scale
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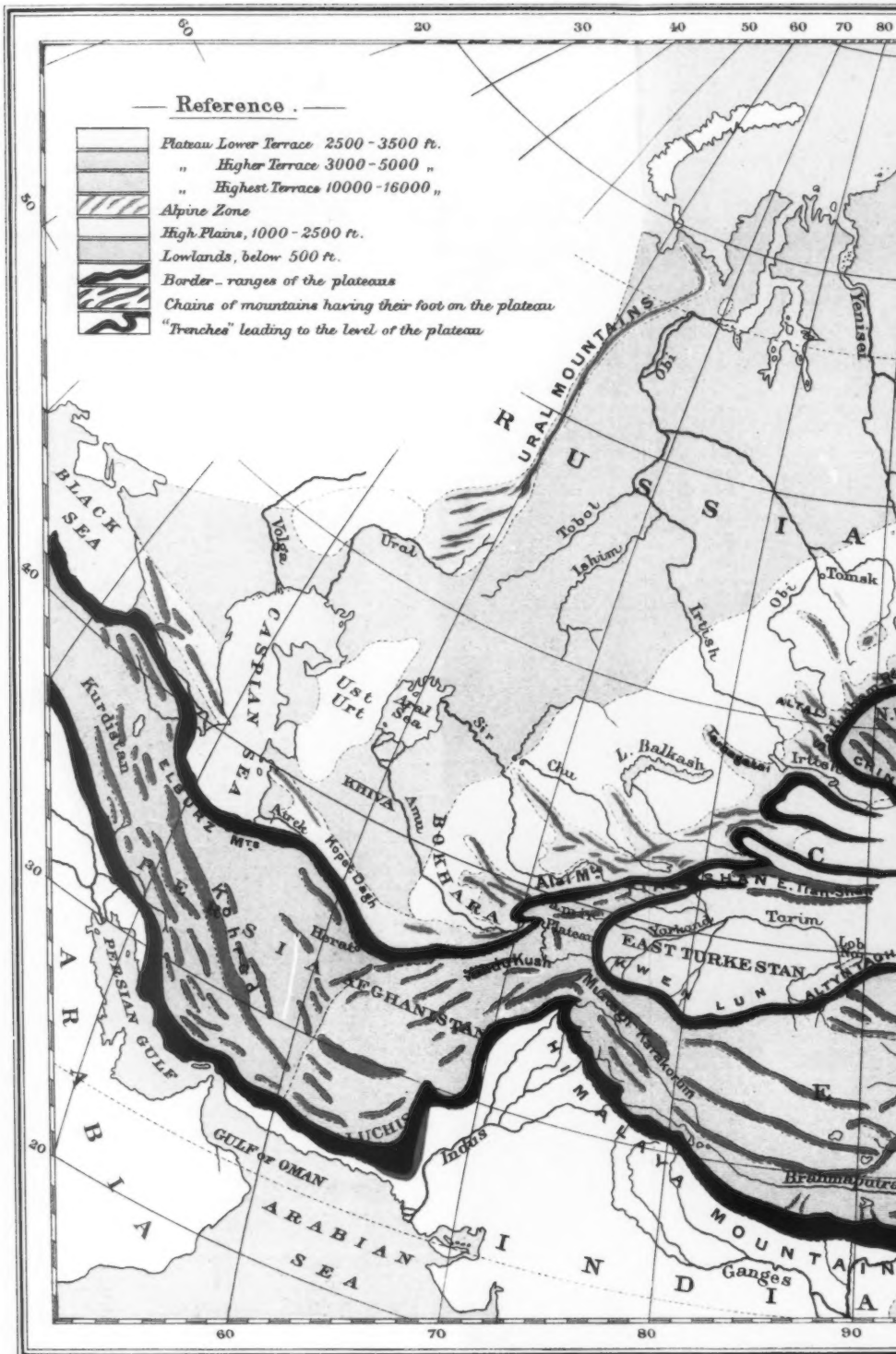


Modified Conical Equal Area (Bonnes) projection

Published by the

HICAL MAP OF ASIA.

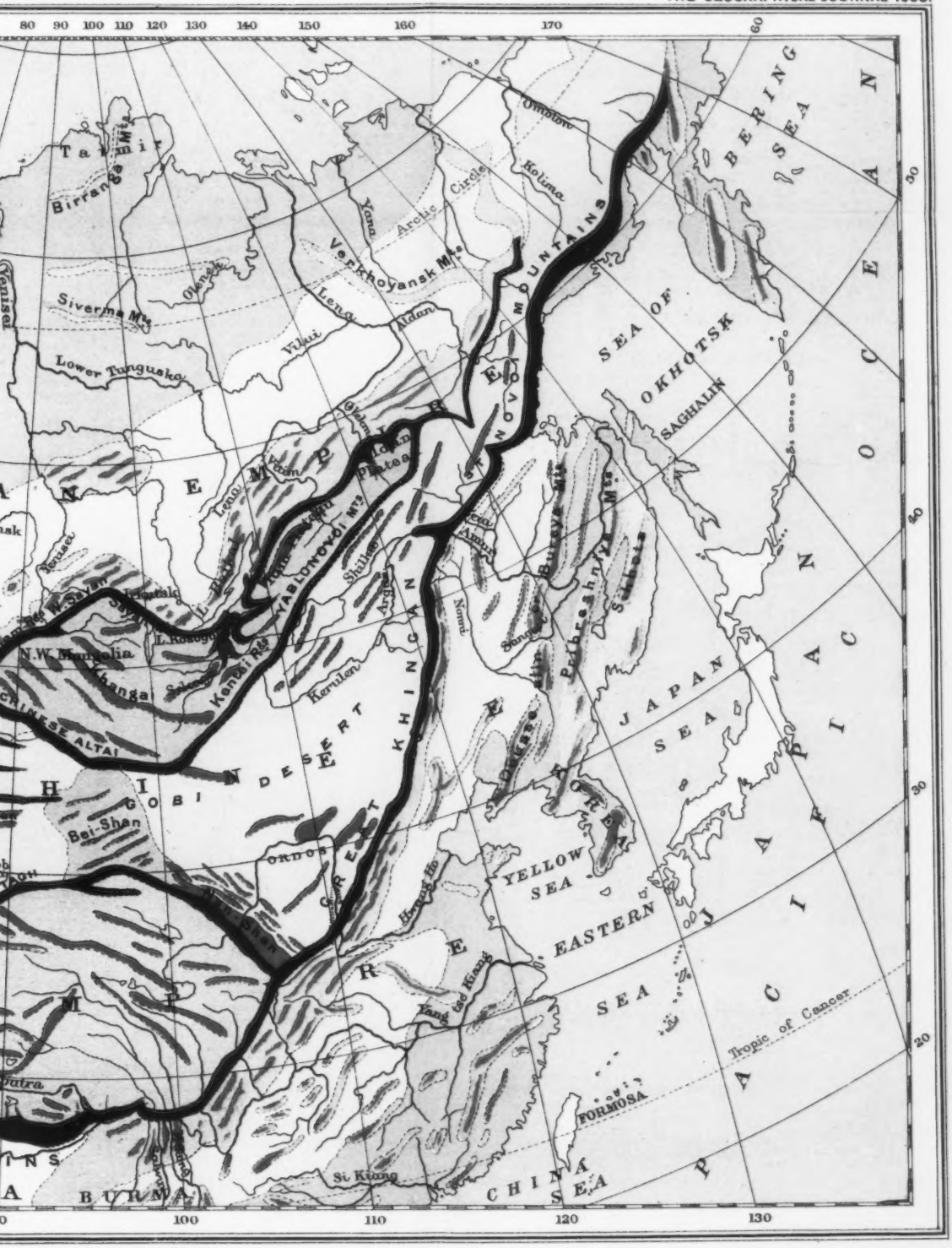
By

. KROPOTKIN.

Scale of Miles.

0 100 200 300 400 500

1:30,000,000 or 474 miles = 1 inch.



the Royal Geographical Society.

OROGRAPHICAL MAP
OF
EASTERN SIBERIA
AND PARTS OF
MONGOLIA AND MANCHURIA.

By
P. KROPOTKIN.

Scale of Miles.

100 50 0 100 200

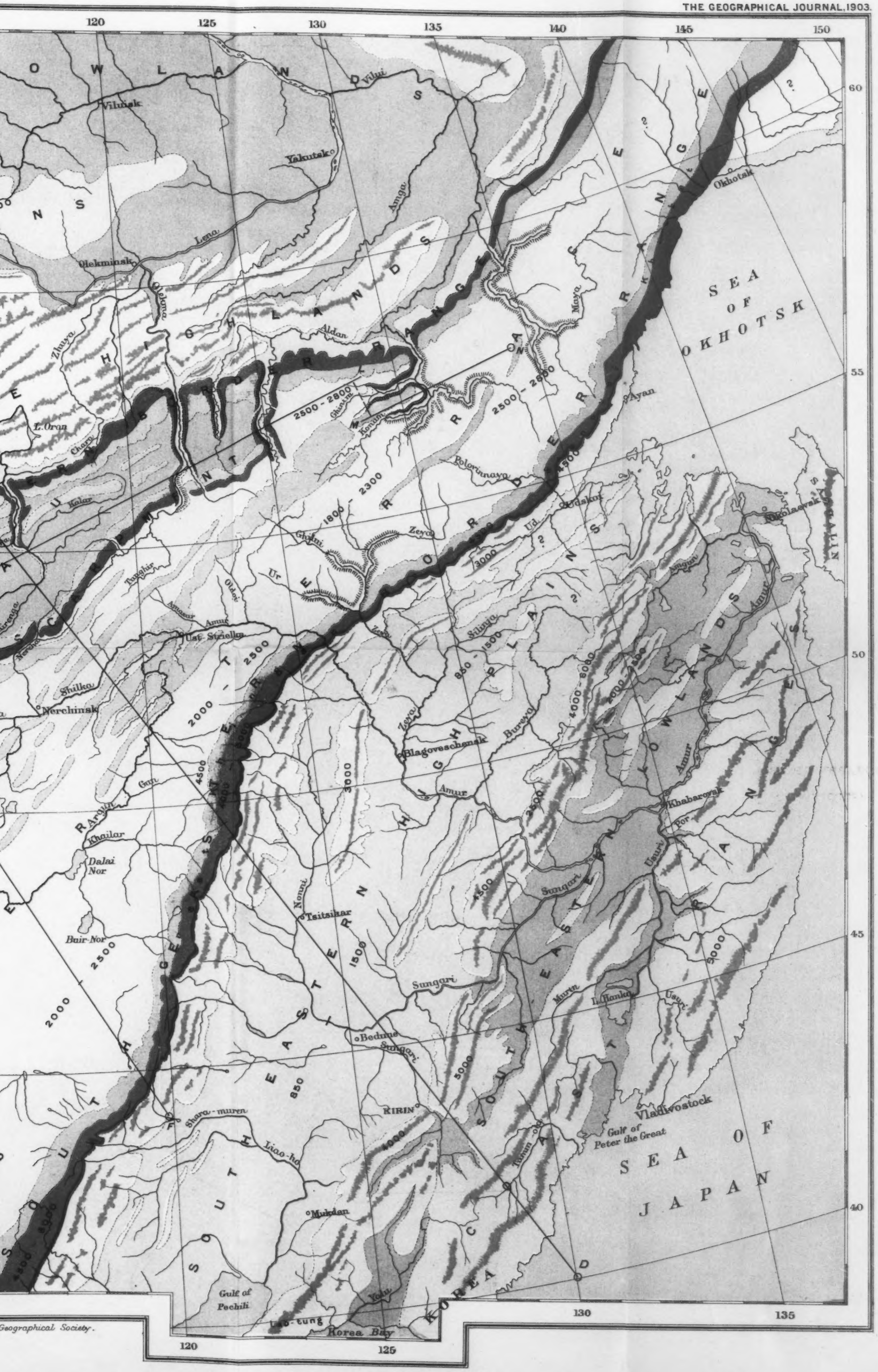
Nat. Scale 1 : 7,500,000 or 118·35 miles = 1 inch.

Reference.

- High Plateau
- Its Lower Terrace
- High Plains
- Lowlands
- Alpine Highlands; the darker markings represent the direction of the mountain ranges.
- Border Ranges of the Plateaus
- Ranges of Mountains having their foot on the surface of the plateau.
- "Trenches" leading with a gentle gradient from the plains to the surface of the plateau.
- The lines A.B.C.D. etc. represent the directions along which cross sections are given.
- 6000 — 7000 ..... Altitudes in English feet

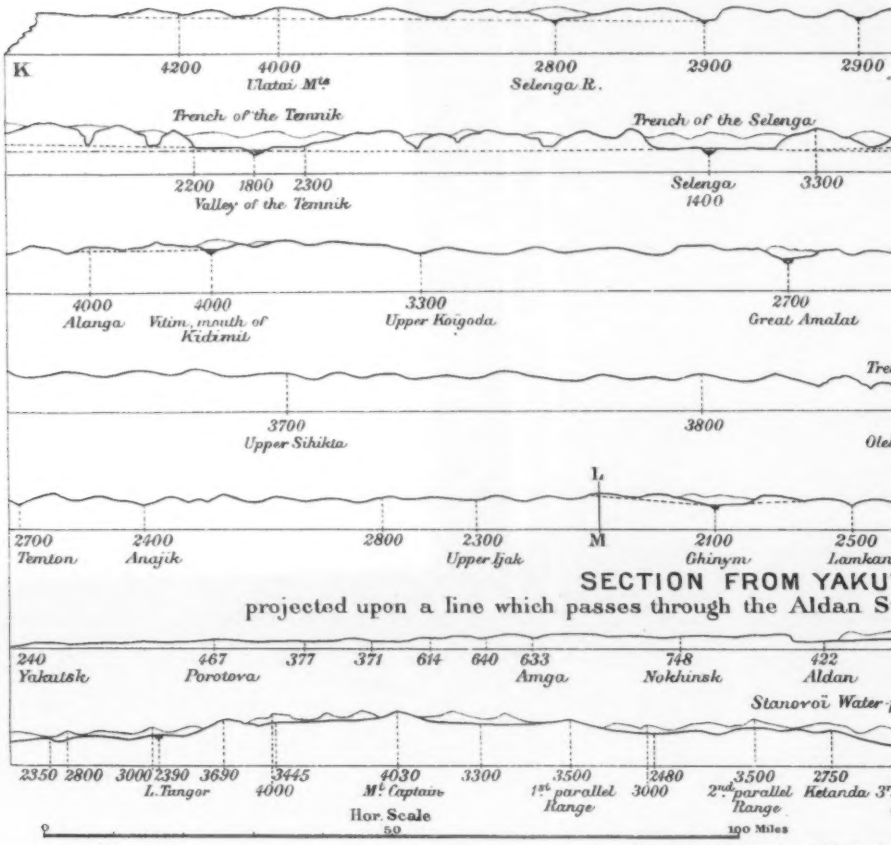
Modified Conical Equal Area (Bonnes) projection.

Published by the Royal Geog



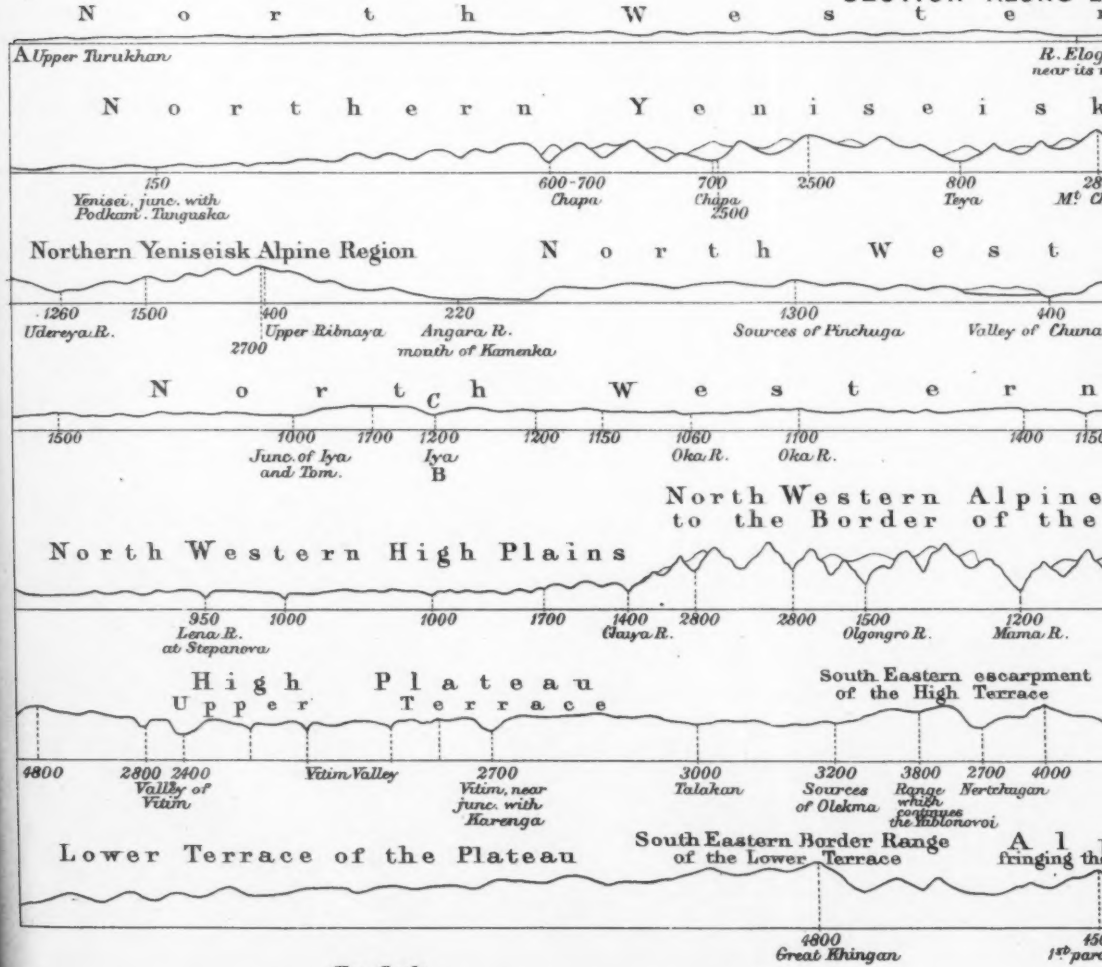
Geographical Society.

LONGITUDINAL SECTION OF
from the Sources of the Selenga to the Maya, tributa



SECTION FROM YAKU
projected upon a line which passes through the Aldan S

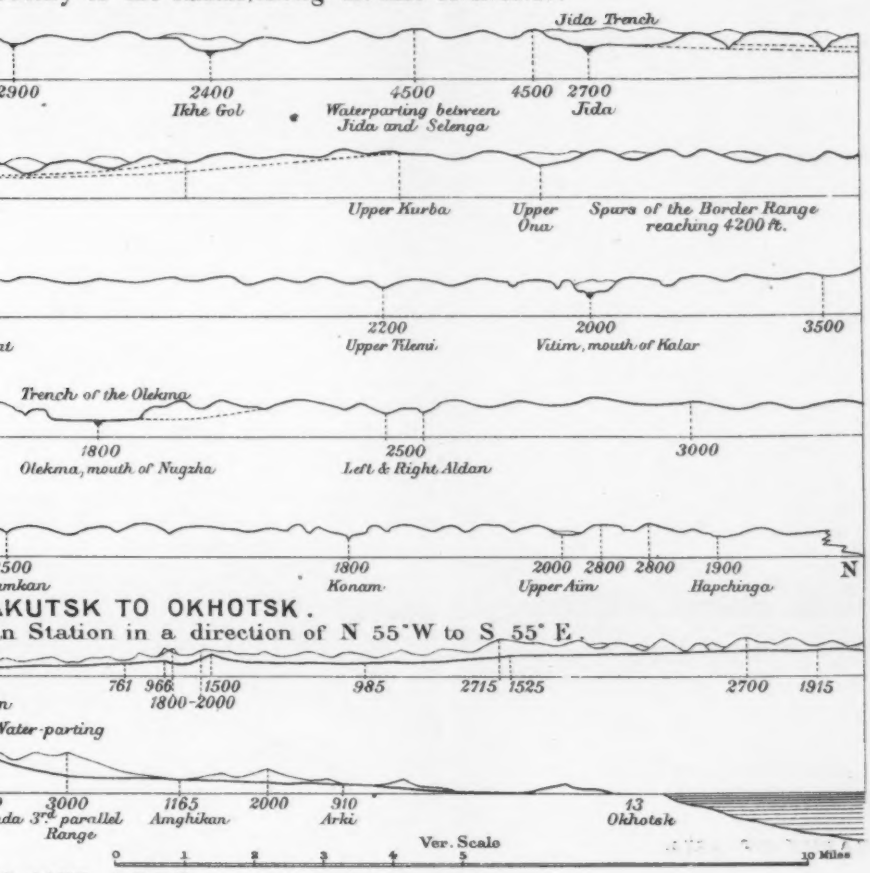
SECTION ALONG L
North Western



Published by the Roya

OF THE HIGH PLATEAU.

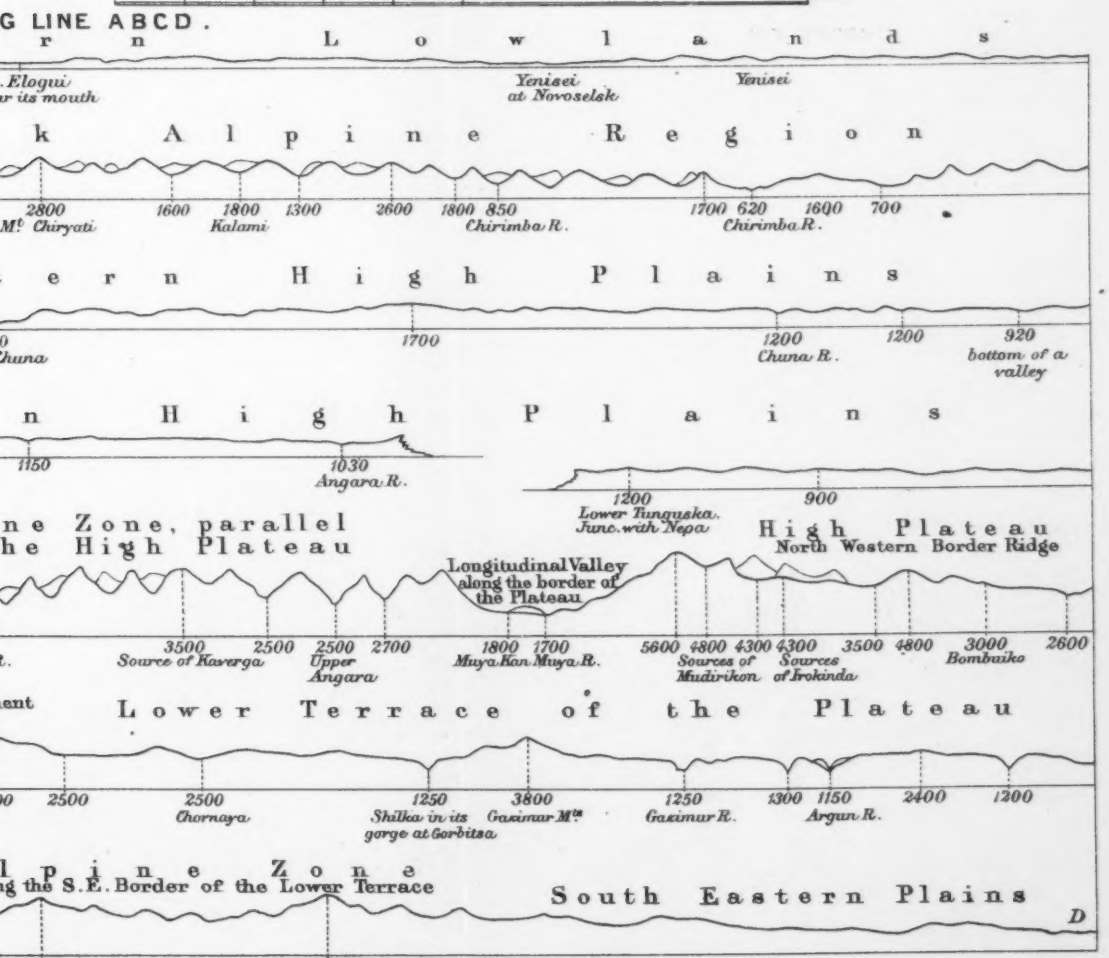
outary of the Aldan, along the line K.L.M.N.



AKUTSK TO OKHOTSK.

n Station in a direction of N 55° W to S 55° E.

G LINE ABCD.



e Royal Geographical Society

Heights in English Feet.

BRITISH EAST AFRICA

SKETCH MAP

showing the route of

Mr. H. R. TATE

from

NAKURU TO THE RENDILE COUNTRY

1902.

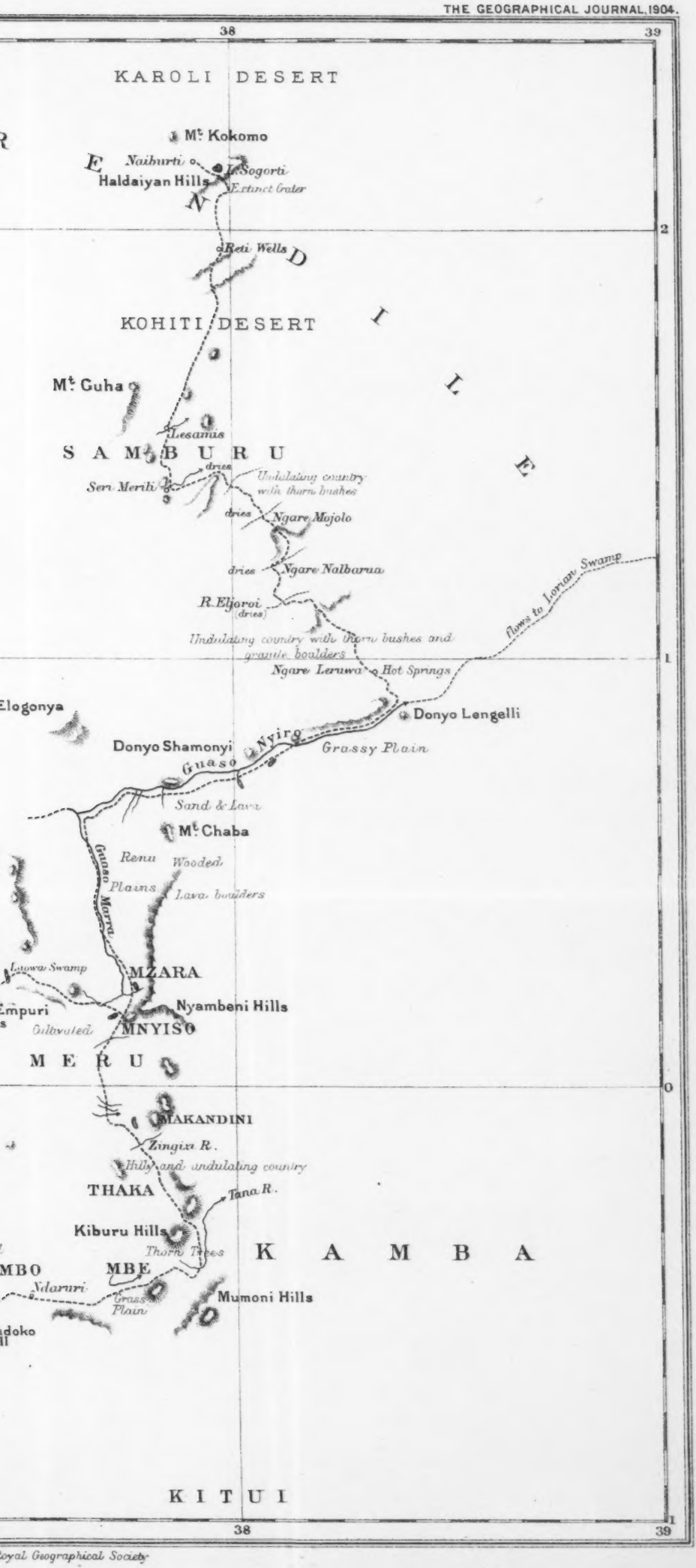
Scale of Miles.

10 5 0 10 20 30 40 50

Nat. Scale 1:1,250,000 or 1 inch = 19·72 miles

Route ----------

Published by the Royal


38
39
KAROLI DESERT
Mt. Kokomo
Naiburti
Mt. Sogorti
Haldaiyan Hills
Extinct Crater
N
E
Rei Wells
D
I
KOHITI DESERT
L
Mt. Guha
E
Lesamis
S A M B U R U
dries
Undulating country with thorn bushes
Seri Merili
dries
Ngare Mojolo
dries
Ngare Nalbarua
R. Elgorai
(dries)
Undulating country with thorn bushes and granite boulders
flows to Lorian Swamp
Ngare Leruwa
Hot Springs
Elogonya
Donyo Lengelli
Donyo Shamonyi
Nyiro
Grassy Plain
Guaso
Sand & Lava
Mt. Chaba
Renu
Wooded
Plains
Lava boulders
Guaso Narra
Lagowa Swamp
MZARA
Empuri
Nyambeni Hills
Cultivated
MNYISO
M E R U
MAKANDINI
Zingira R.
Hilly and undulating country
THAKA
Tana R.
Kiburu Hills
Thorn Trees
K A M B A
MBO
MBE
Ndaruri
Grass Plain
Mumoni Hills
doko
KITUI
38
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